Chapter 4 Environmental Consequences

4.1 Introduction

This chapter analyzes the impacts of each alternative for seabird interaction avoidance methods and pelagic squid jig fishery management by alternative for each environmental resource category. In some instances the impacts of various alternatives are sufficiently similar that the analyses are consolidated. Direct and indirect impacts are discussed in the individual resource sections of this chapter; cumulative impacts are discussed separately afterwards. A concluding section evaluates the seabird action alternatives according to the qualitative and quantitative criteria established for that purpose in Chapter 2 and summarizes the potential impacts of the squid fishery management alternatives.

It is important to recognize that the pelagic ecosystem responds to ambient climatic and oceanographic conditions on a variety of spatial and temporal scales and that, even in the complete absence of any fishing, stock sizes fluctuate, sometimes quite dramatically. It is also clear from the species accounts that initiation of very marked declines in some groups—such as sea turtles, seabirds and possibly sharks—coincided with operations of the high seas drift-gillnet fishery in the 1980s and early 1990s. Added to the serious impacts to protected species resulting from that fishery was a regime shift that markedly lowered the carrying capacity and productivity of the ecosystem at that time. Because of the long life spans and limited reproductive potential of sea turtles, seabirds and sharks, these populations are likely to be only beginning to recover from these circumstances.

The alternatives for monitoring and management of the squid jigging fisheries would only affect the high seas industrial-scale fishery. The small-scale, coastal squid jig fisheries around Hawaii would continue to be monitored and managed through the State of Hawaii commercial licensing and catch reporting system.

4.2 Impacts to the Pelagic Environment

4.2.1 Seabird Interaction Avoidance Methods

Only Alternative SB1 (the No Action Alternative) and the alternatives that offer an option to employ current measures, Alternatives SB2-SB8, SB10 and SB11, potentially impact the pelagic environment, and that would be through the discharge of offal and spent bait. Direct impacts would include insignificant, transient and localized reductions of water quality. There would be no detectable indirect effects to the pelagic environment.

The impacts of deep- and shallow-set longline gear used by the Hawaii-based longline fishery on EFH and HAPC were evaluated in the Pelagics FEIS (NMFS 2001a) and the Pelagics SEIS (WPRFMC 2004b). Implementation of additional or different seabird avoidance measures would not change the fishing gear. Impacts resulting from use of that gear in conjunction with seabird avoidance measures would be temporary and minimal, arising primarily from discharge of offal. No additional adverse impacts to EFH or HAPC will result and no EFH consultation is required.

4.2.2 Squid Jig Fishery Management Alternatives

Squid vessels have the typical discharges associated with any ocean-going vessel, including bilge water, sanitary waste, garbage, etc. They also discharge offal from the on-board processing of the squid. With the possible exception of Alternative SQB.2, cessation of issuing HSFCA permits for squid fishing, none of the alternatives for squid jig fishery management would change current impacts of these vessels. Alternative SQB.2 would eventually (when current permits expire) result in fewer vessels fishing for squid. To the extent these vessels would be completely removed from service of any kind, there would be fewer ships at sea, with concomitantly reduced discharges of solid and liquid wastes. It is more likely however, that these vessels would be reconfigured for other uses, including service in other fisheries. In that event, the direct impact on the pelagic environment would be a reduction of wastes discharged from squid vessels, and the indirect impact would be an increase in the discharge of waste from the rededicated vessels. The net effect would depend on the wastes generated in the new use or uses to which the vessels are put as compared with current discharges, but given the current number of vessels involved in the squid fishery, these impacts would be insignificant.

Alternative SQB.2, which would result in phasing out of the high seas squid jig fishery, would eventually, when all HSFCA permits for high seas squid jigging expire, result in the complete elimination of impacts from this fishery to EFH or HAPC. For all of the remaining alternatives, impacts to EFH and HAPC from the fishing gear and practices described in Section 3.7.3 for the high seas jig fishery would, as for the longline fishery, derive from the discharge of offal. The gear itself would have no impact on EFH or HAPC. Potential impacts would be temporary and minimal. The coastal squid jig fisheries may also discharge a small amount of offal or spent bait, but these impacts would also be temporary and minimal. No additional adverse impacts to EFH or HAPC will result and no EFH consultation is required.

4.3 Impacts to Squid

4.3.1 Seabird Interaction Avoidance Methods

As for the pelagic environment, only Alternative SB1 (the No Action Alternative) and the alternatives that offer an option to employ current measures, Alternatives SB2-SB8, SB10 and SB11, potentially impact squid resources. The impacts would be indirect and caused by strategic offal and spent bait discard, and minimization of lights during nighttime operations. Offal discharge could represent a food subsidy to squid as it sinks through the water column, or it might attract predators on squid. Minimization of lights would incrementally reduce the attraction of squid prey and squid to a vessel at night compared to the situation without light minimization. Neither of these impacts would be significant.

4.3.2 Squid Jig Fishery Management Alternatives

The alternatives for monitoring and management of the U.S. pelagic squid fishery are, for the most part, not designed to control the harvest of squid or limit fishing mortality of squid, but rather to better understand the fishery and the condition of the squid resources so that control measures could be instituted at some future time should the condition of the resources require it. Again with the exception of Alternative SQB.2, cessation of issuing HSFCA permits for squid fishing, none of the alternatives for squid jig fishery management would change current impacts of U.S. vessels on squid resources. Impacts on the resource base could increase with increased future effort, possible under any of the alternatives except Alternative SQB.2. This is why increasing our understanding of the status of the stocks and fishing mortality would be an important outcome of this action. Alternative SQB.2 would eventually (when current permits expire) result in fewer vessels fishing for squid and reduced squid harvests. The U.S. involvement in this fishery however, is very small compared with the aggregated foreign effort and harvests. The U.S. squid fisheries, including net fisheries, are responsible for less than 3.5% of the world's harvest (see Section 3.7.3.1.1), with the squid jigging fishery a small percentage of that. It is unlikely that cessation of U.S. squid jigging effort would have any discernable effect on squid stocks.

4.4 Impacts to PMUS and Non-PMUS

4.4.1 Seabird Interaction Avoidance Methods

The current measures of Alternative SB1 (the No Action alternative) may indirectly and insignificantly affect PMUS or other pelagic species by providing a localized food subsidy through strategic offal or spent bait discard. To the extent any of the other alternatives would facilitate bait retention on the hook, either through reduced bird depredation or reduced mechanical loss, catch rates of PMUS and non-PMUS could increase somewhat. Given however, that most baits are not taken during a set, such an effect is not likely to be significant. None of the seabird interaction avoidance measure alternatives would directly affect PMUS or other pelagic species.

4.4.2 Squid Jig Fishery Management Alternatives

It is unlikely that any of the squid jig fishery management alternatives would have a significant direct or indirect impact on PMUS or non-PMUS. The bycatch in the squid jigging fishery is reported to be extremely small (see Section 3.4.5). Sharks are occasionally hooked, but break the relatively weak squid lines before being boated. Only Alternative SQB.2 would alter the current U.S. pelagic squid fishery by phasing it out as permits expire. The indirect effect of this alternative on PMUS or non-PMUS would depend on the use or uses to which the displaced vessels are put. However, even if all four current squid vessels were to begin fishing for PMUS, their landings would be insignificant in the context of the international fisheries for these species in the Pacific Ocean.

There do not appear to be substantive bycatch issues in the fishery at present (see Section 3.4.5). Alternatives SQA.3 (Sub-objective A Preferred Alternative), SQA.4, SQB.4 Sub-objective B Preferred Alternative), SQB.5 and SQB.6 would provide a mandatory level of monitoring that provides a suitable level of confidence that bycatch is not a concern and a mechanism for considering and responding to changes in circumstances affecting bycatch.

4.5 Impacts to Seabirds

Information requirements for analyzing seabird-longline interactions are complicated for three reasons: first, the natural systems in which seabirds and longline fisheries are active are complex, with wide variation in natural variability at seasonal, annual and longer-term scales; second, human interventions into the natural environment affecting seabirds are widely spread over time and space, with activities decades old still affecting seabird populations; and third, the available information from monitoring seabird populations is limited.

The objective of the proposed action is to cost-effectively reduce the adverse effects of the incidental catch of seabirds by longline vessels operating under the Pelagics FMP. The Hawaii-based longline fishery is the only fishery operating under the Pelagics FMP with observed catches of seabirds, predominately black-footed and Laysan albatrosses that breed in the NWHI. Besides the direct mortality to juvenile or adult birds, fishing-related deaths may also have a negative affect on chick survival if one or both parent birds are killed. Thus, the impact of the interactions is more serious if the albatrosses killed are predominantly adult birds because this results not only in the consequent loss of chicks they are caring for, but also the loss of many breeding seasons as the surviving mate must find another mate and establish a pair bond.

For the purposes of this assessment, it is assumed that the Hawaii longline fishery as it operated prior to 1999 had the greatest mortality factor on albatross populations. If this assumption is correct, then in the short-term reductions in the incidental catch of seabirds by the Hawaii longline fishery would most likely result in: 1) increases in chick survival as both parents would be available to feed the chick; and 2) increases in breeding frequency due to decreases in mate loss. In the long-term, seven to eight years after implementing a regulatory action to reduce seabird bycatch, albatross populations would most likely see an increase in juvenile recruitment as juveniles tend to be the birds most susceptible to being caught by longline gear (Brothers 1991, Cousins 2001).

4.5.1 Alternative SB1: No action

Alternative SB1 is considered the baseline case against which all other alternatives are compared. Alternative SB1 reflects the Terms and Conditions outlined in the BiOp for short-tailed albatross published by the USFWS in November 2000, and subsequently revised on October 18, 2001, and November 18, 2002 (Table 4.5-1) to only apply to the deep-set sector of the fishery, and the BiOp of October 8, 2004 for the shallow-set sector of the fishery.

In general, under Alternative SB1 the operators of all vessels registered for use under a Hawaii longline limited entry permit operating with longline gear north of 23°N latitude, must ensure the use of thawed, blue-dyed bait and strategic offal discards to distract birds during setting and hauling of longlines. The offal discard must be made from the opposite side of the vessel from which the longline is being set or hauled (no fish, fish parts, or bait may be discarded from the side of the vessel where the longline is being set or hauled), and all hooks must be removed from discarded fish, fish parts or bait prior to its discard. When making deep-sets (targeting tuna) north of 23°N latitude, Hawaii longline vessel operators must employ a line-setting machine with weighted branch lines (minimum weight: 45 g), or employ basket-style longline gear. Other interaction avoidance measures such as tori lines, use of weighted branch lines without a line-setting machine (in the case of shallow-sets) are optional. If a short-tailed albatross is brought onboard alive, vessel operators and crew must ensure that the albatross displays four traits before release, and they must notify NMFS immediately. Included in this alternative is a requirement that all seabirds brought onboard alive must be handled in a manner that maximizes the probability of their long-term survival once released. Also, vessel captains, as well as vessel owners, must annually complete a protected species workshop conducted by NMFS. Current regulations (69 FR 17329, April 2, 2004) allow a limited amount of shallow-set longline effort (2,120 sets annually) by Hawaii-based longline vessels using circle hooks with mackerel-type bait. Vessel operators making shallow-sets must begin setting the longline at least one hour after local sunset and complete the setting process by local sunrise, using only the minimum vessel lights necessary.

Table 4.5-1 Current Seabird Interaction Avoidance Measures.

Seabird Measures	North of 23°N	
A. Seabird Interaction Avoidance Methods	Tuna (deep) set	Swordfish (shallow) set
1. Thawed, blue-dyed bait	Required	Required
2. Strategic Offal Discharge	Required	Required
3. Line-setting machine with weighted branch lines (minimum wt. = 45 g); or employ basket-style longline gear [1]	Required	Not Required (Optional)
4. Night-Setting	Not Required (Optional)	Required
5. Towed deterrent (buoy/tori line)	Not Required (Optional)	Not Required (Optional)
6. Weighted branch lines (minimum weight:45 g)	Required	Not Required (Optional)
B. Careful handling of hooked seabirds	Vessel operators must contact NMFS immediately if they have a hooked/entangled short-tailed albatross. Specific handling guidelines required for short-tailed albatross. Other hooked seabirds must be handled in a manner to maximize survival.	
C. Annual Protected Species Workshops	Required	

[1] The October 18, 2001 USFWS BiOp allowed basket-style, tarred mainline gear as an alternative to monofilament gear set with a line-setting machine and weighted branch lines.

Any one measure employed north of 23°N latitude is estimated to reduce the catch of black-footed and Laysan albatrosses in the Hawaii fishery by 63% to nearly 100% as compared to the 1994-1999 average (Table 2.1-2). The measures evaluated in this document were only tested on black-footed and Laysan albatrosses, and no observations were made of short-tailed albatross captures. However, it is assumed that the measures considered here will be equally as effective in deterring short-tailed albatross (USFWS 2004a)

The targeting of swordfish by the Hawaii-based longline fishery was greatly constrained from late August 2000, to the outright ban on shallow-setting north of the equator in the NMFS emergency rule published June 12, 2001. The impacts of these constraints on albatross interactions after August 2000 led to a marked decline in the incidental catch of albatrosses by Hawaii-based longline vessels. Further, between July and September 2001, there were no observed interactions with seabirds by the Hawaii longline fishery (with over 20% coverage of the fleet) following the complete ban on shallow-set longline fishing for swordfish north of the equator. It is unknown if the incidental catch of seabirds by Hawaii longline vessels using circle hooks with mackerel-type bait will be different from that of vessels setting shallow and operating as they did prior to 1999 (i.e, targeting swordfish using J-hooks with squid as bait). The 2004 SEIS (WPRFMC 2004b) analyzed the circle hooks and conclude they may have a benefit in reducing the effects of hooking.

Table 4.5-3 provides projections of the numbers of albatross that would be captured under each of the alternatives, given the stated assumptions. These projections should not be viewed as predictions for the reasons described below. Rather, they are useful for comparisons of the numbers of potential seabird interactions under each alternative. Under Alternative SB1 (No Action), the total number of seabirds projected to be captured by Hawaii-based longline vessels is 97 birds per year. The majority (84) of the captures would be by deep-setting vessels fishing south of 23°N latitude.

4.5.2 Alternative SB2A: Use either current methods or side-setting north of 23°N

Under this alternative, operators of Hawaii longline vessels could elect to either (a) continue to use the current measures described under Alternative SB1 (the No Action Alternative), or (b) employ side-setting when fishing north of 23°N latitude. Hawaii longline vessel operators opting to side-set would be required to comply with the following specifications:

1. Attach 60 g weights within 1 m of the hook on each branchline;
2. Side-set as far forward from the stern as possible;
3. Deploy a bird curtain between the setting position and the stern, constructed consistent with the specifications given by NMFS;
4. Throw baited hooks forward as close to the vessel hull as possible; and,
5. Clip deployed branchlines to the mainline the moment that the vessel passes the baited hook to minimize tension in the branchline, which could cause the baited hook to be pulled towards the sea surface.

Compared to the No Action Alternative, Alternative SB2A offers Hawaii-based longline fishermen greater flexibility to achieve the regulatory objective (i.e., fishermen can elect to maintain operating under the current suite of measures or use side-setting). The side-setting method requires the use of 60 g of weight within one meter of the hooks as well as the deployment of a bird curtain. Researchers did not test how much the bird curtain contributed to the effectiveness of the side-setting method (Gilman et al. 2003), nor did the researchers note seabirds becoming acclimated to the bird curtain. If used as specified, side-setting could reduce the incidental catch of seabirds by the Hawaii-based longline fishery by 99-100% (Gilman et al. 2003). Under Alternative SB2A, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 8 by deep-setting vessels and 3 by shallow-setting vessels.

4.5.3 Alternative SB2B: Use either current methods or side-setting in all areas

The effects would be similar to those described for Alternative SB2A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude. Fishermen would be required to use in all areas side-setting or the suite of interaction avoidance measures currently required of vessels operating north of 23°N latitude. Under Alternative SB2B, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 3 by deep-setting vessels and 3 by shallow-setting vessels.

4.5.4 Alternative SB3A: Use either current methods or underwater setting chute north of 23°N

In comparison to Alternative SB1 (the No Action Alternative), this alternative offers fishermen flexibility to achieve the action objective by allowing them to choose to use either the current seabird interaction avoidance methods or to set the longline using an underwater setting chute. Under Alternative SB3A, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 86 by deep-setting vessels and 60 by shallow-setting vessels.

4.5.5 Alternative SB3B: Use either current methods or underwater setting chute in all areas

The effects would be similar to those described for Alternative SB3A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude. Under Alternative SB3B, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 18 by deep-setting vessels and 55 by shallow-setting vessels.

4.5.6 Alternative SB4A: Use either current methods or tori line north of 23°N

This alternative differs from Alternative SB1 (the No Action Alternative) by offering longline fishermen the option to either use the suite of interaction avoidance measures as described in Table 4.5-1 or to use a tori line. Tori lines have proven effective in demersal longline fisheries in Alaska (Melvin et al. 2001), but have not been developed specifically for use in pelagic longline fisheries such as in Hawaii. Under Alternative SB4A, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 115 by deep-setting vessels and 196 by shallow-setting vessels. This alternative had the highest projected total interactions of all the alternatives due to the relatively low efficacy value of tori lines.

4.5.7 Alternative SB4B: Use either current methods or tori line in all areas

The effects would be similar to those described for Alternative SB4A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude. Under Alternative SB4B, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 57 by deep-setting vessels and 191 by shallow-setting vessels. This alternative had the second highest projected number of captures of all the alternatives.

4.5.8 Alternative SB5A: Use either current methods or side-setting or underwater setting chute north of 23°N

The effects would be similar to those described for Alternatives SB1 (the No Action Alternative), SB2A and SB3A, except that this alternative would provide fishermen with flexibility to achieve the action objective (e.g., fishermen that have vessels unsuitable for side-setting may install an underwater setting chute). Under Alternative SB5A, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 17 by deep-setting vessels and 10 by shallow-setting vessels.

4.5.9 Alternative SB5B: Use either current methods or side-setting or underwater setting chute in all areas

The effects would be similar to those described for Alternative SB5A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude. Under Alternative SB5B, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 4 by deep-setting vessels and 9 by shallow-setting vessels.

4.5.10 Alternative SB6A: Use either current methods or side-setting or underwater setting chute or tori line north of 23°N

The effects would be similar to those described for Alternative SB5A, except that this alternative would provide fishermen with even greater flexibility to achieve the action objective (e.g., fishermen that have vessels unsuitable for side-setting may install an underwater setting chute or use a tori line). Under Alternative SB6A, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 29 by deep-setting vessels and 30 by shallow-setting vessels.

4.5.11 Alternative SB 6B: Use either current methods or side-setting or underwater setting chute or tori line in all areas

The effects would be similar to those described for Alternative SB6A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude. Under Alternative SB6B, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 10 by deep-setting vessels and 29 by shallow-setting vessels.

4.5.12 Alternative SB7A: Use either current measures or side-setting or tori line north of 23°N

Under Alternative SB7A, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 21 by deep-setting vessels and 25 by shallow-setting vessels.

4.5.13 Alternative SB7B: Use either current measures or side-setting or tori line in all areas

Under Alternative SB7B, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 8 by deep-setting vessels and 24 by shallow-setting vessels.

4.5.14 Alternative SB7C: For shallow-sets: use either current measures (without blue-dyed bait) or underwater setting chute or side-setting or tori line in all areas. For deep-sets: use either current measures (without blue-dyed bait) or underwater setting chute or side-setting or tori line north of 23°N

The effects would be similar to those described for Alternative SB6A, except those fishermen that choose to use current measures would avoid the operational difficulties of using blue-dyed bait. Under Alternative SB7C, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 31 by deep-setting vessels and 30 by shallow-setting vessels.

4.5.15 Alternative SB7D (Preferred Alternative): For shallow-sets: use either current measures plus a tori line or use side-setting in all areas. For deep-sets: use either current measures plus a tori line or side-setting with a line-shooter and weighted branch lines north of 23°N

This is the Preferred Alternative. Under Alternative SB7, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 4 by deep-setting vessels and 2 by shallow-setting vessels.

4.5.16 Alternative SB7E: For shallow-sets: use either current measures without blue-dyed bait or strategic offal discard, or use side-setting in all areas. For deep-sets: use either current measures without blue-dyed bait or strategic offal discard, or use side-setting north of 23°N

Under Alternative SB7E, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 12 by deep-setting vessels and 5 by shallow-setting vessels.

4.5.17 Alternative SB8A: Use current mitigation measures plus side-setting north of 23°N

Under Alternative 8A, all interaction avoidance measures are non-discretionary. Both current measures and side-setting are required when fishing north of 23°N latitude. The requirement to side-set may eliminate fishing opportunities north of 23°N latitude for some longline vessels in the fleet which cannot be readily reconfigured for side-setting. Some smaller vessels may be unable to be reconfigured for side-setting because of structural limitations. Under Alternative SB8A, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 0 by deep-setting vessels and 0 by shallow-setting vessels.

4.5.18 Alternative SB8B: Use current mitigation measures plus side-setting in all areas

The effects would be similar to those described for Alternative SB8A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude. Smaller vessels that are unable to be reconfigured for side-setting would be prevented from fishing with pelagic longline gear. Under Alternative SB8B, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 0 by deep-setting vessels and 0 by shallow-setting vessels. This alternative would be the "Environmentally Preferred Alternative" as it is projected to match the zero interactions of Alternative SB8A and also implement seabird avoidance measures in all areas fished by the fleet.

4.5.19 Alternative SB9A: Use side-setting north of 23°N

The effects would be similar to those described for Alternative SB8A, except fishermen will avoid the operational difficulties of using current measures. Under Alternative SB9A, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 0 by deep-setting vessels and 2 by shallow-setting vessels.

4.5.20 Alternative SB9B: Use side-setting in all areas

The effects would be similar to those described for Alternative SB9A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude. Under Alternative SB9B, the projected numbers of seabirds captured per year by Hawaii-based vessels are 1 by deep-setting vessels and 2 by shallow-setting vessels.

4.5.21 Alternative SB10A: Use-side-setting unless technically infeasible in which case use current measures north of 23°N

The effects would be similar to those described for Alternative SB2A. Alternative SB10A allows those longline vessels that are unable to adapt their vessels to side-setting to still fish using the current measures.

Under Alternative SB10A, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 5 by deep-setting vessels and 2 by shallow-setting vessels.

4.5.22 Alternative SB10B: Use side-setting unless technically infeasible in which case use current measures in all areas

The effects would be similar to those described for Alternative SB10A, except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude.

Under Alternative SB10B, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 2 by deep-setting vessels and 2 by shallow-setting vessels.

4.5.23 Alternative SB11A: Use side-setting unless technically infeasible, in which case use an underwater setting chute or a tori line or current measures without blue bait or strategic offal discards (shallow-setting vessels set at night, deep-setting vessels use line-shooters with weighted branch lines), when fishing north of 23°N

The effects would be similar to those described for Alternative SB6A, except those fishermen that choose to use current measures will avoid the operational difficulties of using blue-dyed bait and strategic offal discard. Under Alternative SB11A, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 9 by deep-setting vessels and 14 by shallow-setting vessels.

4.5.24 Alternative SB11B: Use side-setting unless technically infeasible, in which case use an underwater setting chute or a tori line or current measures without blue bait or

strategic offal discards (shallow-setting vessels set at night, deep-setting vessels use line-shooters with weighted branch lines), in all areas

The effects would be similar to those described for Alternative SB11A , except that this alternative would provide additional protection to albatrosses and other seabird species foraging below 23°N latitude. Under Alternative SB11B, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 8 by deep-setting vessels and 10 by shallow-setting vessels.

4.5.25 Alternative SB12: Voluntarily use night-setting or underwater setting chute or tori line or line-shooter with weighted branch lines south of 23°N

This alternative assumes that current measures would continue to be applied above 23°N latitude and that some percentage of vessels would voluntarily employ interaction avoidance measures south of that. Under Alternative SB12, the projected numbers of seabirds captured per year by Hawaii-based longline vessels are 72 by deep-setting vessels and 8 by shallow-setting vessels.

4.5.26 Comparison of the Projected Efficacy of the Seabird Alternatives

This section presents a comparison of projections of potential seabird interactions under each of the seabird action alternatives. In order to project the numbers of interactions, it is first necessary to establish the appropriate baseline interaction rates for deep and shallow sets, above and below 23°N latitude. Interactions of the Hawaii-based longline fleet with seabirds vary with set type, fishing location and season. Historical data were provided by the longline observer program of PIRO with analytical support from PIFSC. McCracken (Memo of Oct. 15, 2004) estimated black-footed and Laysan albatross interaction rates per set and per 1,000 hooks for two time periods (1994-1999 and 2002-2003) and four strata. The strata were defined by the number of hooks per float. Deep sets were those with 15 or more hooks per float and shallow sets were those with less than 15 hooks per float. North sets were those where the maximum latitude of the set was at or north of 23°N latitude, and south sets were those where the maximum latitude was below 23°N latitude. Because of the prohibition of shallow setting in the 2002-2003 period, only deep set data are available for that period. The estimated interaction rates are summarized in Table 4.5-2.

Table 4.5-2 Estimated Black-footed and Laysan Albatross Interaction Rates in the Hawaii-based Longline Fishery for Two Time Periods.

Strata	Black-footed Albatross Interactions		Laysan Albatross Interactions		Total Interactions	
	per Set	per 1,000 hooks	per Set	per 1,000 hooks	per Set	per 1,000 hooks
1994-1999						
South Deep	0.00741	0.00445	0.00841	0.00505	0.01582	0.00951
South Shallow	0.00809	0.00972	0.00841	0.01011	0.01650	0.01983

Strata	Black-footed Albatross Interactions		Laysan Albatross Interactions		Total Interactions	
	per Set	per 1,000 hooks	per Set	per 1,000 hooks	per Set	per 1,000 hooks
North Deep	0.03898	0.02396	0.03117	0.01916	0.07016	0.04312
North Shallow	0.29853	0.36648	0.24730	0.30359	0.54583	0.67007
2002-2003						
South Deep	0.00545	0.00276	0.00254	0.00129	0.00799	0.00405
North Deep	0.00673	0.00334	0.01704	0.00845	0.02378	0.01179

Source: McCracken unpub. 2004.

Within the 1994-1999 data set, several trends are apparent. Most obvious are that: 1) interaction rates are greater in the north than in the south, and 2) interaction rates for shallow sets are greater than for deep sets. The rates for north shallow sets are much greater than for any other strata.

The 2002-2003 data show the same trend of interactions being higher in the north, but the absolute rates for deep sets are considerably lower than in the earlier data set. There are likely several factors contributing to this. First, the two data sets are not strictly comparable because of differences in the operation of the observer program between those times. In the 1994-1999 period, observer coverage was around 5% and observers were preferentially placed aboard large vessels (i.e., more likely swordfish vessels) intending to fish shallow or mixed sets to the north where bird encounters were more likely. These rates therefore may be an overestimate of actual rates, although by how much is unknown. In the 2002-2003 period, with approximately 20% observer coverage, observers were placed aboard vessels in a random statistical design. Other externalities potentially affecting comparisons of these two data sets may include bird abundance, fishing effort by season and other factors.

However, the most important difference between the two data sets is that the 2002-2003 data represent interaction rates after implementation of regulations requiring thawed, blue-dyed bait and strategic offal discard for deep-setting vessels setting north of 23°N latitude (Line-shooters with a minimum of 45 g weight on branch lines were used during both periods.) Thus, all other things being equal, the interaction rates for deep sets south of 23°N latitude where no deterrent measures were required in either period should be about the same for both data sets. This is not the case, however, and the 2002-2003 rates are overall about half those of the earlier period. Whether this is an artifact of the changing characteristics of the observer program or other externalities cannot be determined. Comparing the north deep strata for the two periods, again all things being equal, should provide an estimate of the efficacy of the deterrent measures for deep sets. The north deep interaction rate reduction is around 70%, but interpretation is confounded by the reduction of about 50% in the south (unmitigated) deep interaction rate. Also of interest, is that the two albatross species had quite different trends in their interaction rate reductions between the two data sets. Black-footed albatross interaction rates showed more than an 80% reduction in the north, after imposition of deterrent measures, while Laysan albatross interaction rates showed only about a 50% reduction. Gilman et al. (2003) tested side-setting, underwater setting chutes and blue-dyed bait and concluded that "Black-footed albatrosses were generally more effectively prevented from interacting with fishing gear than Laysan albatrosses.

This may be a reflection of black-footed albatrosses being generally less capable of interacting with gear than Laysan albatrosses." Conversely, in the south, presumably without additional deterrent measures, black-footed albatross interaction rates showed about a 30% reduction between the two periods while Laysan albatross interaction rates declined about 70%. The reasons for this are uncertain, but McCracken (pers. comm., 12/1/04) believes the 2002-2003 interaction rates are much more representative because of the statistical design of observer placement and the density of observer coverage. Despite the uncertainties in these rates, they are the best available data, and are used in the analysis below.

Table 4.5-3 presents a comparison of projections of potential seabird interactions under each of the seabird action alternatives. Consistent assumptions are used throughout the analysis, but it is crucial to understand that these are only assumptions, and how the fishery might respond to implementation of any given alternative might be very different from what is here assumed. The following paragraphs explain the individual data columns and calculations that were made to generate the projected interactions under each alternative.

Assumptions
The total number of sets that would be made under each alternative is a constant, 14,285. This is the average number of sets made in the fleet in 2002 and 2003. Sets are apportioned to deep (tuna), shallow (swordfish), north (north of 23°N latitude) and south (south of 23°N latitude). Shallow swordfish sets permitted under the current management regime total 2,120. The expected number of deep tuna sets is therefore 14,285 - 2,120 = 12,165.[44] For deep sets, the 2002-2003 effort data (Appendix D) were used to calculate the percentages of sets north and south of 23°N latitude. The shallow-set sector of the fishery was closed in the 2002-2003 period. Complete effort distribution data from 1994-1998 logbooks were used to generate the comparable percentages of sets north and south of 23°N latitude (NMFS unpub. data). Implicit in these assumptions is that none of the alternatives would affect overall effort, or its distribution between the two gear types. It is also assumed that all vessels in the fleet could convert to side-setting under those alternatives mandating its use. One additional assumption was made. That was that if vessels were projected to side-set north of 23°N latitude, then, by default, they would also side-set south of 23°N latitude.

[44]The total number of swordfish sets actually made in a given year is likely to be less than 2,120 under the current system of set allocation. After requests for allocations are made, the maximum possible number of sets is divided by the number of requesters and the resulting share is rounded down into a whole number of sets, so the fractional leftover is effectively subtracted from the maximum possible limit of 2,120, resulting in an actual limit in any given year that will in almost all years be less than 2,120. Moreover, fewer than 2,120 shallow-sets may result in fewer interactions with seabirds, but this would depend on how many deep sets were made, what proportion of these occurred to the north of the Hawaiian Islands where interactions are expected to be higher, and the relative efficacies of seabird interaction avoidance measures in effect in the two sectors of the fleet.

Choice %
This column projects the percentages of vessels that would choose each of the various options under each alternative. Percentages were assigned subjectively based on expected implementation costs of each option and a judgement of how the qualitative criteria used in the analysis of the avoidance measures (operational characteristics and compliance) might influence vessel operators in their selection of an option from among those available under each alternative.

No. Sets
This column is the product of "Choice %" times the appropriate percentage for the type of set (from the assumptions above) times the total number of deep or shallow sets (also from the assumptions above). Results are rounded to whole sets, and where necessary due to rounding errors, a set is added or subtracted from the category having the most sets to sum to 14,285.

Base Interaction Rate
For deep tuna sets north of 23°N latitude, the baseline seabird capture rate, before implementation of any seabird capture avoidance measures, is the rate (in interactions per set) calculated by PIFSC staff from observer data collected between 1994 and 1999 (McCracken 2004) (see Table 4.5-2). For deep tuna sets south of 23°N latitude, however, the comparable 2002-2003 data were used because no seabird capture avoidance measures were required in either case and the latter data were collected in a more comprehensive sampling regime. For baseline shallow-set seabird capture rates, no data are available for the 2002-2003 period, as that sector of the fishery was closed. Therefore, the 1994-1999 data were used for the baseline pre-seabird capture avoidance measure rates. A proportionally blended rate was calculated for options applicable to all areas.

Base Interactions
This column is the product of the "No. Sets" and "Base Interaction Rate" columns, and represents the number of interactions in the absence of any seabird interaction avoidance measures.[45]

Efficacy
The rates here are taken from those summarized in Table 2.1-2 from experimental longlining using the various seabird interaction avoidance measures. Where combinations of measures are an option, the efficacy values calculated in Section 2.1.4.2 are used.

Interactions
This column is the product of the "Base Interactions" times "Efficacy."

Interactions by Sector
Total interactions for all tuna and all swordfish sets are summed, giving the two values in this column for each alternative.

[45] Deep-setting tuna vessels use line-shooters and weighted branch lines, which have interaction avoidance properties. However, they are part of standard tuna longlining gear, and were in use during the baseline period for interaction rate calculation. For this exercise, they are not assumed to contribute to interaction avoidance efficacies.

Interactions by Alternative
The two values for tuna and swordfish interactions shown in the previous column are summed to give the total interactions by alternative.

<u>It should be clearly understood that this table should not be interpreted as predicting the expected seabird captures under any alternative.</u> There are numerous confounding factors that may come into play, including annual seabird density variations, distribution of fishing effort in space and time (there is geographic and seasonal variability to capture rates), percentages of fishermen who would choose the various options within the alternatives, the rate of compliance with regulations by fishermen, conditions under which measures are implemented (e.g., night setting under a full moon), etc. The efficacy values used are from experimental trials with the interaction avoidance measures; actual efficacies may vary substantially in commercial fishing operations, even when best efforts are made to comply with regulatory specifications. The value of these calculations is that they present, ***<u>at best</u>***, a measure of the ***<u>relative</u>*** effectiveness of the many alternatives.

Table 4.5-3 Seabird Interaction Projections By Alternative.

Assumptions:		Abbreviations:			
1. Total sets =	14285	SF	Swordfish	TBDB	Thawed, Blue-Dyed Bait
2. Shallow sets =	2120	CM	Current Measures	SOD	Strategic Offal Discard
3. Deep sets =	12165	N	North of 23°N		
4. Deep sets N =	25.40%	S	South of 23°N		
5. Deep sets S =	74.60%	SS	Side-set		
6. Shallow sets N =	86.70%	USC	Underwater Setting Chute		
7. Shallow sets S =	13.30%	TL	Tori Line		

Alternative	Sector	Area	Measure	Choice %	No. Sets	Base Interaction Rate	Base Inter-actions	Efficacy	Inter-actions	Inter-actions by Sector	Interactions by Alternative
SB1 (No	Tuna	N '(94-99)'	CM	100.00%	3090	0.07016	217	94.82%	11		
Action)		S '(02-03)	none	100.00%	9075	0.00799	73	0.00%	73	84	
	SF	N '(94-99)'	CM	100.00%	1838	0.54583	1003	99.25%	8		
		S '(94-99)	none	100.00%	282	0.01650	5	0.00%	5	13	97
SB2A	Tuna	N	CM	10.00%	309	0.07016	22	94.82%	1		
		N	SS	90.00%	2781	0.07016	195	99.80%	0		
	SF	N	CM	10.00%	184	0.54583	100	99.25%	1		
		N	SS	90.00%	1654	0.54583	903	99.80%	2		
	Tuna	S	none	10.00%	908	0.00799	7	0.00%	7		
		S	SS	90.00%	8167	0.00799	65	99.80%	0	8	
	SF	S	none	10.00%	28	0.01650	0	0.00%	0		
		S	SS	90.00%	254	0.01650	4	99.80%	0	3	11
SB2B	Tuna	All	CM	10.00%	1217	0.02378	29	94.82%	2		
			SS	90.00%	10948	0.02378	260	99.80%	1	3	
	SF	All	CM	10.00%	212	0.47542	101	99.25%	1		
			SS	90.00%	1908	0.47542	907	99.80%	2	3	6
SB3A	Tuna	N	CM	10.00%	309	0.07016	22	94.82%	1		
			USC	90.00%	2781	0.07016	217	94.00%	12		
	SF	N	CM	10.00%	184	0.54583	100	99.25%	1		
			USC	90.00%	1654	0.54583	903	94.00%	54		
	Tuna	S	none	100.00%	9075	0.00799	73	0.00%	73	86	
	SF	S	none	100.00%	282	0.01650	5	0.00%	5	60	146
SB3B	Tuna	All	CM	10.00%	1217	0.02378	29	94.82%	2		
			USC	90.00%	10948	0.02378	260	94.00%	16	18	
	SF	All	CM	10.00%	212	0.47542	101	99.25%	1		
			USC	90.00%	1908	0.47542	907	94.00%	54	55	73
SB4A	Tuna	N	CM	10.00%	309	0.07016	22	94.82%	1		
			TL	90.00%	2781	0.07016	195	79.00%	41		
	SF	N	CM	10.00%	184	0.54583	100	99.25%	1		
			TL	90.00%	1654	0.54583	903	79.00%	190		
	Tuna	S	none	100.00%	9075	0.00799	73	0.00%	73	115	
	SF	S	none	100.00%	282	0.01650	5	0.00%	5	196	311
SB4B	Tuna	All	CM	10.00%	1217	0.02378	29	94.82%	2		
			TL	90.00%	10948	0.02378	260	79.00%	55	57	
	SF	All	CM	10.00%	212	0.47542	101	99.25%	1		
			TL	90.00%	1908	0.47542	907	79.00%	190	191	248
SB5A	Tuna	N	CM	10.00%	309	0.07016	22	94.82%	1		
			SS	80.00%	2472	0.07016	173	99.80%	0		
			USC	10.00%	309	0.07016	22	94.00%	1		
	SF	N	CM	10.00%	184	0.54583	100	99.25%	1		
			SS	80.00%	1470	0.54583	802	99.80%	2		
			USC	10.00%	184	0.54583	100	94.00%	6		
	Tuna	S	none	20.00%	1815	0.00799	15	0.00%	15		
			SS	80.00%	7260	0.00799	58	99.80%	0	17	
	SF	S	none	20.00%	56	0.01650	1	0.00%	1		
			SS	80.00%	226	0.01650	4	99.80%	0	10	27

Alternative	Sector	Area	Measure	Choice %	No. Sets	Base Interaction Rate	Base Inter-actions	Efficacy	Inter-actions	Inter-actions by Sector	Interactions by Alternative
SB5B	Tuna	All	CM	10.00%	1217	0.02378	29	94.82%	2		
			SS	80.00%	9731	0.02378	231	99.80%	0		
			USC	10.00%	1217	0.02378	29	94.00%	2	4	
	SF	All	CM	10.00%	212	0.47542	101	99.25%	1		
			SS	80.00%	1696	0.47542	806	99.80%	2		
			USC	10.00%	212	0.47542	101	94.00%	6	9	13
SB6A	Tuna	N	CM	10.00%	309	0.07016	22	94.82%	1		
			SS	70.00%	2162	0.07016	152	99.80%	0		
			USC	10.00%	309	0.07016	22	94.00%	1		
			TL	10.00%	309	0.07016	22	79.00%	5		
	SF	N	CM	10.00%	184	0.54583	100	99.25%	1		
			SS	70.00%	1287	0.54583	702	99.80%	1		
			USC	10.00%	184	0.54583	100	94.00%	6		
			TL	10.00%	184	0.54583	100	79.00%	21		
	Tuna	S	none	30.00%	2723	0.00799	22	0.00%	22		
			SS	70.00%	6352	0.00799	51	99.80%	0	29	
	SF	S	none	30.00%	85	0.01650	1	0.00%	1		
			SS	70.00%	197	0.01650	3	99.80%	0	30	59
SB6B	Tuna	All	CM	10.00%	1217	0.02378	29	94.82%	2		
			SS	70.00%	8514	0.02378	202	99.80%	0		
			USC	10.00%	1217	0.02378	29	94.00%	2		
			TL	10.00%	1217	0.02378	29	79.00%	6	10	
	SF	All	CM	10.00%	212	0.47542	101	99.25%	1		
			SS	70.00%	1484	0.47542	706	99.80%	1		
			USC	10.00%	212	0.47542	101	94.00%	6		
			TL	10.00%	212	0.47542	101	79.00%	21	29	39
SB7A	Tuna	N	CM	10.00%	309	0.07016	22	94.82%	1		
			SS	80.00%	2472	0.07016	173	99.80%	0		
			TL	10.00%	309	0.07016	22	79.00%	5		
	SF	N	CM	10.00%	184	0.54583	100	99.25%	1		
			SS	80.00%	1470	0.54583	802	99.80%	2		
			TL	10.00%	184	0.54583	100	79.00%	21		
	Tuna	S	none	20.00%	1815	0.00799	15	0.00%	15		
			SS	80.00%	7260	0.00799	58	99.80%	0	21	
	SF	S	none	20.00%	56	0.01650	1	0.00%	1		
			SS	80.00%	226	0.01650	4	99.80%	0	25	46
SB7B	Tuna	All	CM	10.00%	1217	0.02378	29	94.82%	2		
			SS	80.00%	9731	0.02378	231	99.80%	0		
			TL	10.00%	1217	0.02378	29	79.00%	6	8	
	SF	All	CM	10.00%	212	0.47542	101	99.25%	1		
			SS	80.00%	1696	0.47542	806	99.80%	2		
			TL	10.00%	212	0.47542	101	79.00%	21	24	32
SB7C	Tuna	N	CM-TBDB	10.00%	309	0.07016	22	86.00%	3		
			SS	70.00%	2163	0.07016	152	99.80%	0		
			USC	10.00%	309	0.07016	22	94.00%	1		
			TL	10.00%	309	0.07016	22	79.00%	5		
	Tuna	S	none	30.00%	2723	0.00799	22	0.00%	22		
			SS	70.00%	6352	0.00799	51	99.80%	0	31	
	SF	All	CM-TBDB	10.00%	212	0.47542	101	97.97%	2		
			SS	70.00%	1484	0.47542	706	99.80%	1		
			USC	10.00%	212	0.47542	101	94.00%	6		
			TL	10.00%	212	0.47542	101	79.00%	21	30	61
SB7D	Tuna	N	CM+TL	5.00%	155	0.07016	11	98.91%	0		
(Preferred			SS	95.00%	2937	0.07016	206	99.80%	0		
Alternative)	Tuna	S	none	5.00%	454	0.00799	4	0.00%	4		
			SS	95.00%	8621	0.00799	69	99.80%	0	4	
	SF	All	CM+TL	5.00%	106	0.47542	50	99.84%	0		
			SS	95.00%	2014	0.47542	957	99.80%	2	2	6

Alternative	Sector	Area	Measure	Choice %	No. Sets	Base Interaction Rate	Base Inter-actions	Efficacy	Inter-actions	Inter-actions by Sector	Interactions by Alternative
SB7E	Tuna	N	CM+TL-TB DB&SOD	10.00%	309	0.07016	22	79.00%	5		
			SS	90.00%	2781	0.07016	195	99.80%	0		
	Tuna	S	None	10.00%	908	0.00799	7	0.00%	7		
			SS	90.00%	8167	0.00799	65	99.80%	0	12	
	SF	All	CM+TL-TB DB&SOD	10.00%	212	0.47542	101	96.96%	3		
			SS	90.00%	1908	0.47542	907	99.80%	2	5	17
SB8A	Tuna	N	CM+SS	100.00%	3090	0.07016	217	99.99%	0		
	SF	N	CM+SS	100.00%	1838	0.54583	1003	100.00%	0		
	Tuna	S	SS	100.00%	9075	0.00799	73	99.80%	0	0	
	SF	S	SS	100.00%	282	0.01650	5	99.80%	0	0	0
SB8B	Tuna	All	CM+SS	100.00%	12165	0.02378	289	99.99%	0	0	
	SF	All	CM+SS	100.00%	2120	0.47542	1008	100.00%	0	0	0
SB9A	Tuna	N	SS	100.00%	3090	0.07016	217	99.80%	0		
	SF	N	SS	100.00%	1838	0.54583	1003	99.80%	2		
	Tuna	S	SS	100.00%	9075	0.00799	73	99.80%	0	0	
	SF	S	SS	100.00%	282	0.01650	5	99.80%	0	2	2
SB9B	Tuna	All	SS	100.00%	12165	0.02378	289	99.80%	1	1	
	SF	All	SS	100.00%	2120	0.47542	1008	99.80%	2	2	3
SB10A	Tuna	N	SS if feasible	95.00%	2935	0.07016	206	99.80%	0		
			CM	5.00%	155	0.07016	11	94.82%	1		
	SF	N	SS if feasible	95.00%	1746	0.54583	953	99.80%	2		
			CM	5.00%	92	0.54583	50	99.25%	0		
	Tuna	S	SS if feasible	95.00%	8621	0.00799	69	99.80%	0		
			none	5.00%	454	0.00799	4	0.00%	4	5	
	SF	S	SS if feasible	95.00%	268	0.01650	4	99.80%	0		
			none	5.00%	14	0.01650	0	0.00%	0	2	7
SB10B	Tuna	All	SS if feasible	95.00%	11557	0.02378	275	99.80%	1		
			CM	5.00%	608	0.02378	14	94.82%	1	2	
	SF	All	SS if feasible	95.00%	2014	0.47542	957	99.80%	2		
			CM	5.00%	106	0.47542	50	99.25%	0	2	4
SB11A	Tuna	N	SS if feasible	95.00%	2935	0.07016	206	99.80%	0		
			CM-TBDB& SOD	2.00%	62	0.07016	4	0.00%	4		
			USC	1.00%	31	0.07016	2	94.00%	0		
			TL	2.00%	62	0.07016	4	79.00%	1		
	SF	N	SS if feasible	95.00%	1746	0.54583	953	99.80%	2		
			CM-TBDB& SOD	2.00%	37	0.54583	20	85.50%	3		
			USC	1.00%	18	0.54583	10	94.00%	1		
			TL	2.00%	37	0.54583	20	79.00%	4		
	Tuna	S	none	5.00%	454	0.00799	4	0.00%	4		
			SS if feasible	95.00%	8621	0.00799	69	99.80%	0	9	
	SF	S	none	5.00%	14	0.01650	0	0.00%	0		
			SS if feasible	95.00%	268	0.01650	4	0.00%	4	14	23
SB11B	Tuna	All	SS if feasible	95.00%	11558	0.02378	275	99.80%	1		
			CM-TBDB& SOD	2.00%	243	0.02378	6	0.00%	6		
			USC	1.00%	122	0.02378	3	94.00%	0		
			TL	2.00%	243	0.02378	6	79.00%	1	8	

Alternative	Sector	Area	Measure	Choice %	No. Sets	Base Interaction Rate	Base Inter-actions	Efficacy	Inter-actions	Inter-actions by Sector	Interactions by Alternative
	SF	All	SS if feasible	95.00%	2014	0.47542	957	99.80%	2		
			CM-TBDB& SOD	2.00%	42	0.47542	20	85.50%	3		
			USC	1.00%	21	0.47542	10	94.00%	1		
			TL	2.00%	42	0.47542	20	79.00%	4	10	18
SB12	Tuna	S	SS	10.00%	908	0.00799	7	99.80%	0		
			USC	1.00%	91	0.00799	1	94.00%	0		
			TL	5.00%	454	0.00799	4	79.00%	1		
			none (Line-shooter)	84.00%	7623	0.00799	61	0.00%	61		
	SF	S	SS	10.00%	28	0.01650	0	99.80%	0		
			USC	1.00%	3	0.01650	0	94.00%	0		
			TL	5.00%	14	0.01650	0	79.00%	0		
			none (Night Set)	84.00%	236	0.01650	4	85.50%	1		
	Tuna	N	CM	90.00%	2781	0.07016	195	94.82%	10		
			SS	10.00%	309	0.07016	22	99.80%	0	72	
	SF	N	CM	90.00%	1654	0.54583	903	99.25%	7		
			SS	10.00%	184	0.54583	100	99.80%	0	8	80

Figures 4.5-1 and 4.5-2 graphically summarize the bird capture projections contained in Table 4.5-3. It must be emphasized again, however, that these projections are not to be taken as estimates of future numbers of interactions. The numerous variables about which assumptions have been made render the products of the exercise relative values, at best.

Figure 4.5-1 Seabird Alternatives Ranked by Projected Number of Interactions.

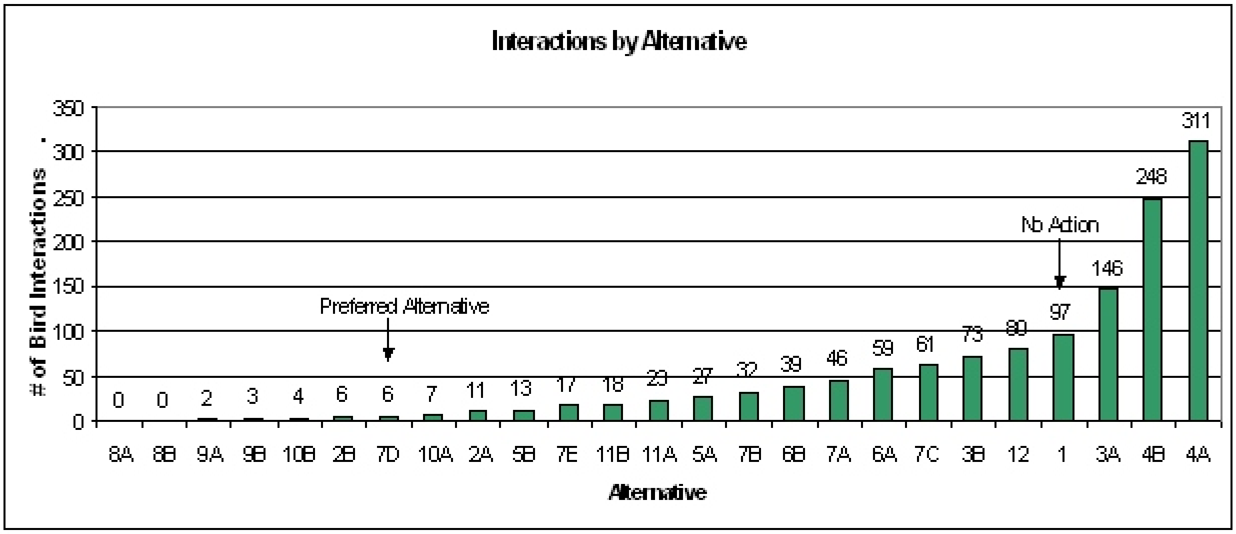

Figure 4.5-2 shows the cumulative interactions by tuna and swordfish vessels under the ranked alternatives. Alternative SB7D is the Preferred Alternative. Alternative SB1 is the No Action Alternative.

Figure 4.5-2 Cumulative Projected Seabird Interactions by Tuna and Swordfish Vessels Under the Seabird Alternatives.

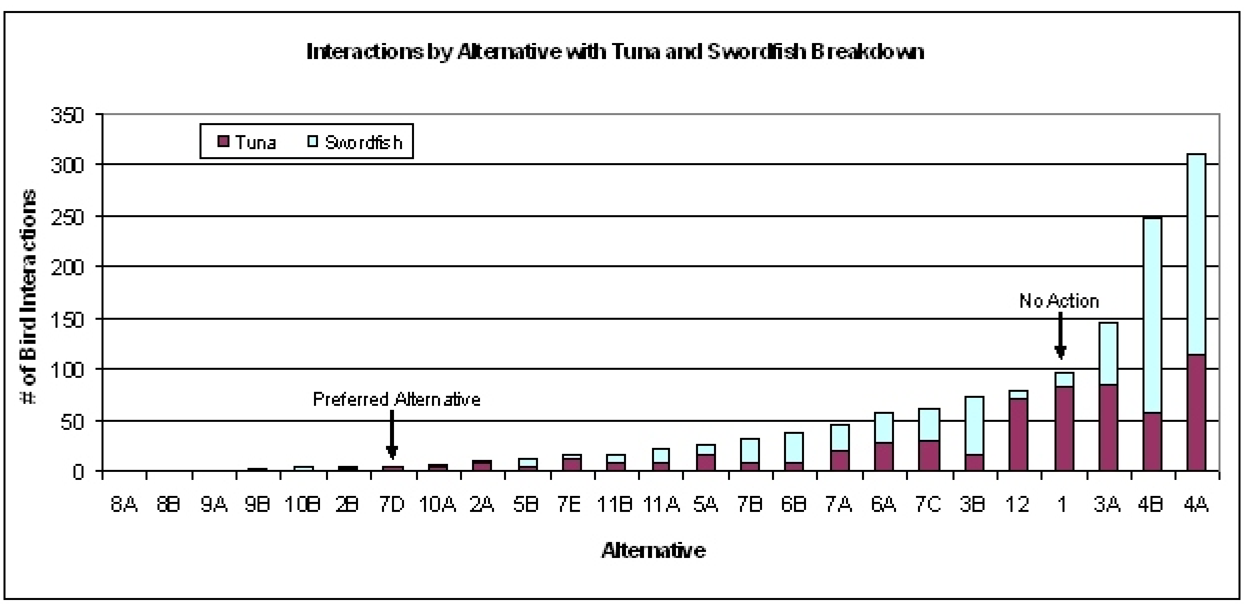

Table 4.5-3 summarized the projected captures of black-footed and Laysan albatrosses under assumed scenarios for choices of options among fishermen under each alternative. Seabird capture rates from experiments in Hawaii with the various interaction avoidance measures (Table 4.5-2) are used to calculate seabird captures. Several factors must be kept in mind when considering these projected numbers of captures, however. First, captures may be greater than projected because:

1. In practice, interaction avoidance measures may not function as well as they do in controlled experiments;
2. Compliance, especially on unobserved trips, may be less than perfect; and
3. Actual choices of optional interaction avoidance measures by fishermen may differ from the projected splits shown in Table 4.5-3.

On the other hand, several factors may reduce the number of captures compared to the projections, including:

1. Although 2120 shallow-sets were authorized, in the first year not all of the set certificates were requested or issued, so the actual maximum number of sets will be less than 2120. This may be the case in subsequent years as well;
2. Some of the issued certificates may go unused due to economic factors related to the certificate allocation scheme and the costs of gearing-up for swordfish fishing;
3. The shallow set sector of the fishery may close early due to reaching turtle interaction limits; and
4. The use in the shallow set sector of the fishery of 18/0 or larger circle hooks which are at least two inches in diameter and thus may be less likely to be swallowed (and if swallowed the curve of the hook may make it less likely than current J hooks to lodge in a seabird's gullet and easier to regurgitate) and thus may reduce the severity of interactions that result in the ingestion of hooks. Although no research on seabirds has been conducted, circle hooks may also lessen the likelihood of external hookings of seabirds as their barbs are turned inwards as compared to J hooks.

The projections in Table 4.5-3 do not account for hooked birds that drop off the hook or are scavenged during the set and are not observed on the haul back. Gilman et al. (2003) estimated that about 30% of hooked birds are lost during the set. The projected captures thus underestimate effects on populations by about 30%. For these reasons, the absolute value of the projected captures under the various alternatives should be de-emphasized in favor of comparisons of relative captures among the alternatives. Nevertheless, given the size and stable status of black-footed and Laysan albatross populations and the low levels of projected captures under the alternatives, it would appear that none of the alternatives would have a discernable impact on the population trajectories of these species.

Further, none of the action alternatives are expected to have negative impacts on the short-tail albatross population because they further reduce the potential for this species to interact with Hawaii-based longline vessels. The expansion of pelagic longline fishing across the North Pacific Ocean in the latter half of the 20th Century appears to have had little to no impact on the exponential growth of the recovering short-tailed albatross population. Reducing the potential for the Hawaii fishery to hook, entangle and drown short-tailed albatross under these alternatives is not expected to have any direct impact on this population, however indirectly, the spread of effective seabird interaction avoidance technology to other fleets will potentially lessen the impact of longline fishing on short-tailed albatross and other seabirds in the North and South Pacific Oceans.

4.5.27 Impacts to Seabirds from Squid Jig Fishery Management Alternatives

The potential for direct and indirect impacts to seabirds is very limited under all of the squid jig fishery management alternatives because of the small domestic fleet that is currently operating at northern latitudes within the feeding range of albatrosses. There may be some potential for several types of impact:

1. Hooking on jigs;
2. Entanglement in jig lines;
3. Greater susceptibility to No. 1 and 2 if shipboard squid processing produces offal that is discarded during jigging operations; and
4. Collision with jigging vessels by seabirds attracted by bright deck lamps, as well as greater susceptibility to No. 1 and 2.

Albatrosses feed near the surface and it is unlikely that they could be incidentally hooked on jigs deployed at night between 30-100 m (deeper during day jigging). Laysan albatross, with better night vision than black-footed albatross can feed under minimal light conditions. It is possible that they would perch on the vessel plunging for hooked squid as it reaches the surface. If they became entangled in this process, depending on the weight of the animal, an albatross might break the line, be pulled onto the deck by rollers, or be stopped or broken loose by rollers. No known logbook, observer or anecdotal information for squid jig fisheries is available documenting seabird entanglements or their possible frequency.

Seabird attraction to squid jigging vessels could be increased if the catch is processed onboard and offal is discarded during fishing operations. If the squid catch is processed onboard and offal is discarded during jigging operations, albatrosses might be attracted to squid vessels. It is unlikely for the squid lamps to affect black-footed albatross during night jigging operations because they feed on squid during the day. Laysan albatross, with better night vision, feed under low light conditions. Seabirds that feed offshore on bioluminescent organisms are particularly drawn to light and may be attracted to the bright deck lamps[46] used to attract squid to jigging vessels. Offal or light attraction could, therefore, expose a larger number of albatrosses to a risk of entanglement. If Laysan albatrosses are attracted to bright squid lamps, they could become temporarily blinded and collide with the vessels. No known logbook, observer or anecdotal information is available to evaluate the latter risk.

Newell's shearwater fledglings are attracted to lights during their first flight to the ocean from their nesting grounds. When attracted to manmade lights, fledglings become confused and may suffer temporary night blindness (Harrison et al. 1984, USFWS 2004c). They often fly into utility wires, poles, trees and buildings and fall to the ground. Between 1978 and 1985, 11,767 Newell's shearwaters struck unseen objects and fell after being blinded by urban lights on Kauai.

[46] Japanese squid jigging vessels were reported to use as many as 100-160 lights of 1-2 kW size in experimental fishing off Oregon and Washington (June and Wilkins 1991), and 88 halogen gas lights of 3-4 kW in experiments in southeastern Australian waters (Nowara and Walker 1998). Spectral characteristics were not given. Lamp type and intensity used on the four U.S. squid jigging vessels are unknown.

Fallout was heaviest during dark periods near the new moon and lightest during brighter periods near the full moon (NACWCP 2000). If squid vessels were to fish within sight during fledging, the bright lights might attract the birds to the vessel.

In the cooperative squid jigging survey conducted by U.S. and Japanese participants in the EEZ off Oregon and Washington in 1990 (June and Wilkins 1991) no birds were observed to be directly affected by the fishing gear or operations.

The AFMA observer program reported that none of the seabirds (1 shy albatross and 2 short-tailed shearwaters) sighted near vessels jigging for squid in southern Australia were observed to interact with either the boats or fishing gear.

Small-boat fishermen use low-wattage surface and underwater lights to attract purpleback flying squid to lures deployed in coastal fisheries. There are no reports of hookings or entanglements of seabirds in Hawaii's small-scale jig fisheries (D. Itano, fishery biologist, pers. comm. to Tony Beeching, NEPA fisheries analyst, WPRFMC, Jan. 7, 2004).

None of the alternatives for squid jig fishery management are expected to change current direct effects on seabirds. Alternative SQB.2 would cease issuing HSFCA permits for U.S. squid vessels, eliminating whatever minor effects may currently exist. However, if the four vessels displaced under this alternative were converted to a fishery with incidental seabird catches, then indirectly, effects on seabirds might increase somewhat. An indirect effect of the squid jig fishery management alternatives that provide for observer coverage (voluntarily under Alternatives SQA.2 and SQB.3; as required by NMFS under Alternatives SQA.3 (Sub-objective A Preferred Alternative) and SQB.4 (Sub-objective B Preferred Alternative)) would improve the sparse information base that is presently available concerning interactions between seabirds and squid jig fisheries.

4.6 Impacts to Sea Turtles

4.6.1 Seabird Interaction Avoidance Methods

Current seabird interaction avoidance measures (Alternative SB1, the No Action Alternative) and those alternatives that contain current measures as an option (Alternatives SB2-SB8, SB10 and SB11) may have minor indirect effects on sea turtles through attraction to offal. Use of a line-shooter with weighted branch lines speeds the longline through the shallow "turtle zone," but this is not required for shallow-sets. To the extent any of the other alternatives would facilitate bait retention on the hook, either through reduced bird depredation or reduced mechanical loss, turtle hookings could increase somewhat for turtles attracted to the bait. On the other hand, leatherback turtles are usually snagged in an extremity, so retained bait could shield the hook. These potential indirect effects would be insignificant. None of the seabird interaction avoidance measure alternatives would directly affect sea turtles.

4.6.2 Squid Jig Fishery Management Alternatives

The potential for direct and indirect impacts to sea turtles is minimal under all of the squid jig fishery management alternatives because of the small domestic fleet that is currently operating in the oceanic fronts and transition zone through which turtles migrate at northern latitudes. There may be some potential for several types of impact:

1. Hooking on jigs;
2. Entanglement in jig lines; and
3. Greater susceptibility to No. 1 and 2 if sea turtles are attracted to luminescent lures or submerged lights.

Some species of sea turtles may try to feed on squid that is hooked on jigs. As squid are hooked, jig lines pull them to the surface over a roller. Whether a turtle would follow hooked squid moving rapidly upward on the jig line is uncertain, but accidental hooking of sea turtles would seem possible. Far more likely, however, is that sea turtles swimming too close to jig lines could become entangled. Depending on the weight of the animal, it might break the line, be pulled onto the deck by rollers or be stopped or broken loose at the rollers. No known logbook, observer or anecdotal information for squid jig fisheries is available documenting any sea turtle entanglements or their possible frequency.

Sea turtles may be attracted to bioluminescent organisms. Some squid lures are luminescent in various colors and U.S. squid vessels have begun to deploy submerged lights when jigging for squid during daylight. It is uncertain if an attraction to lures or submerged lights could expose a larger number of sea turtles to a risk of entanglement in jig lines. No known logbook, observer or anecdotal information is available to evaluate this risk.

None of the alternatives for squid jig fishery management are expected to change current direct effects on sea turtles. Alternative SQB.2 would cease issuing HSFCA permits for U.S. squid vessels, eliminating whatever minor effects may currently exist. However, if the four vessels displaced under this alternative were converted to a fishery with incidental sea turtle catches, then indirectly, effects on sea turtles might increase somewhat. An indirect effect of the squid jig fishery management alternatives that provide for observer coverage (voluntarily under Alternatives SQA.2 and SQB.3; as required by NMFS under Alternatives SQA.3 (Sub-objective A Preferred Alternative) and SQB.4 (Sub-objective B Preferred Alternative)) would improve the sparse information base that is presently available concerning interactions between sea turtles and squid jig fisheries.

4.7 Impacts to Marine Mammals

4.7.1 Seabird Interaction Avoidance Methods

Hawaii-based longline vessels inadvertently interact with marine mammals, whether or not they are using current seabird interaction avoidance measures (Alternative SB1, the No Action Alternative). Direct interactions include bait and catch depredation, hookings, and effects of increased underwater noise. Collisions with fishing vessels are possible, but none have been documented. The other alternatives for seabird interaction avoidance all include options or requirements to use alternative methods of delivering the baits to depth and no direct impacts to marine mammals would be expected. To the extent any of the other alternatives would facilitate bait retention on the hook, either through reduced bird depredation or reduced mechanical loss, interactions with marine mammals could increase somewhat.

4.7.2 Squid jig Fishery Management Alternatives

Direct and indirect effects to marine mammals would be minimal under all of the squid jig fishery management alternatives because the domestic fleet currently operating is small. There may be some potential for several types of impact:

1. Hooking on jigs;
2. Entanglement in jig lines; and
3. Collision of whales with vessels.

Dolphins and small-toothed whales are adept at stealing catch from slow-moving longline gear without becoming hooked themselves. However, marine mammal depredation of squid hooked on jig gear is less likely because the jig line is moving rapidly upward through the water column. More likely than accidental hooking is that marine mammals swimming too close to jig lines could become entangled. As squid are hooked, jig lines pull them to the surface and over a roller. Depending on the weight of the animal, it might break the line, be pulled onto the deck by rollers or be stopped or broken loose at the rollers. No known logbook, observer or anecdotal information for squid jig fisheries is available documenting marine mammal entanglements or their possible frequency.

Whales occasionally collide with vessels moving on the high seas. Large-scale squid jig vessels are held stationary by large sea anchors as they fish, although the boats move between squid grounds. No known logbook, observer or anecdotal information is available to evaluate this risk for squid jigging vessels, but collision would be expected to be a rare event considering the small number of domestic squid vessels presently in operation.

None of the alternatives for squid jig fishery management are expected to change current direct effects on marine mammals. Alternative SQB.2 would cease issuing HSFCA permits for U.S. squid vessels, eliminating whatever minor effects may currently exist. However, the four vessels displaced under this alternative might be converted to uses in which the boats are constantly moving. Collisions with whales might then become more likely than if the vessels were stationary for much of the time, as in the squid jig fishery. An indirect effect of the squid jig fishery management alternatives that provide for observer coverage (voluntarily under Alternatives SQA.2 and SQB.3; as required by NMFS under Alternatives SQA.3 (Sub-objective A Preferred Alternative) and SQB.4 ((Sub-objective B Preferred Alternative)) would be an improvement in the sparse information base that is presently available concerning interactions between marine mammals and squid jig fisheries.

4.8 Economic Impacts

4.8.1 Seabird Mitigation Measures

<u>4.8.1.1 Alternative SB1: No Action</u>

Alternative SB1 is considered the baseline case against which all other alternatives are compared. In general, the description of Alternative SB1 is a projection of the economic performance of the Hawaii-based longline fishery based on the current management regime. The estimation of future economic impacts is difficult because of recent major regulatory changes, the most notable being the reopening of the swordfish portion of the Hawaii longline fishery in April 2004. The expected conditions are likely to differ from the conditions that prevailed in 2003, but uncertainty both about fishermen's responses to the new measures and about trends in factors external to the fishery management regime, such as the condition of pelagic fish stocks and market demand for pelagic fish, hampers reliable estimations of future economic activity. Nevertheless, a projection of conditions expected to exist in the future in the absence of any additional changes in the management regime has been made based on the best data available. Table 4.8-1 summarizes the projected annual catches of the Hawaii-based longline fleet under Alternative SB1.

Table 4.8-1 Predicted Annual Catch of the Hawaii-based Longline Fleet Under Alternative SB1, the No Action Alternative.

	Predicted Catch (million lb)	Percent Change from 1994-1999 Average	Percent Change from 2002[1]
Bigeye tuna	5.9	+ 12.8%	- 39.0%
Albacore tuna	3	+ 18.6%	159.5%
Yellowfin tuna	1.9	+ 12.1%	+ 51.2%
Swordfish[2]	3.62	- 44.8%	+ 700.0%
Miscellaneous	4.2	+ 6.9%	+ 6.1%
Sharks	2.8	- 37.1%	621.6%

[1] 2003 data were not used because the data for that year are still preliminary.
[2] Modeling for this estimate did not take into account a possible increase in swordfish catches when circle hooks with mackerel bait are used. Swordfish catches increased by 30% when this gear and bait were used in the Atlantic longline fishery.
Sources: WPRFMC 2004b and NMFS PIRO.

As a result of the predicted change in pelagic fish landings, ex-vessel revenues in the Hawaii longline fishery are anticipated to increase to $38.9 million, a 4% increase over revenues in 2002. The impact on the seafood marketing sector, fishing supply businesses, and other associated businesses is expected to be proportional to the impact on ex-vessel revenue.

It is possible that the increase in landings and revenues in the Hawaii longline fishery will be even larger if the swordfish vessels that relocated in California after the closure of the swordfish component of the Hawaii longline fishery return to Hawaii. Under the regulations for the re-opened swordfish fishery, a total of 2,120 swordfish sets will be allowed per calender year, or about half of the 1994-1998 average annual number of longline sets targeting swordfish. The average number of vessels targeting swordfish during the 1994-1998 period was 42 (NMFS 2001a). Should the 20 or so California-based longline vessels return to Hawaii, they could conceivably harvest the entire effort limit. Under this scenario the predicted decrease in catch of bigeye tuna would be less, as no Hawaii-based tuna vessels would switch to swordfish fishing.

The estimated economic effects of current and proposed methods to mitigate seabird interactions are summarized in Table 3.7-9. The current methods are expected to continue to have a low economic impact on fishing operations. Vessels targeting tuna (i.e., making deep-sets) routinely use a line-shooter and weighted branch lines. Although vessels targeting swordfish (i.e., making shallow-sets) routinely set at night, the requirement to begin setting the longline at least one hour after local sunset and complete the setting process by local sunrise could potentially have a negative effect on catch rates. Some fishermen claim that hooks set before dusk are more effective. In addition, the night-setting requirement may provide less setting time for vessels fishing at high latitudes during summer months. While there is insufficient information to quantify these effects on catch rates, the impact on the overall economic performance of individual fishing enterprises is expected to be low.

The investment and operational costs of dying bait are small, although some preparation time is required (pre-dyed bait is not commercially available, requiring fishermen to dye the bait blue as it is thawed before each set). The cost of dyeing bait blue using a dye such as Virginia Dare FDC No. 1 Blue Food Additive is about $14 per set (Gilman et al. 2003). Assuming a typical longline vessel makes 100 sets per year, the total annual cost of dyeing bait is about $1,400. Dyeing bait requires that crew spend considerable extra time preparing the bait in lieu of personal time. In addition, blue-dyed bait is messy, dying the crew's hands and clothes and the vessel deck. Notwithstanding these difficulties, some participants in the Hawaii longline fishery routinely dye a portion of their bait blue in order to increase its allure to target fish species.

There are no costs associated with strategic offal discards other than the need to purchase containers to store offal for discarding on the set; the container costs are estimated to be about $150 per year (McNamara et al. 1999).

The equipment required for careful handling of hooked seabirds, including bolt cutters, pliers, knives, and long-handled dip nets, is routinely carried aboard fishing vessels (purchase costs are about $100) (WPRFMC 2004c). The costs to vessel operators of participating in annual protected species workshops are the costs of the participants' time spent at the meetings. The alternatives considered in this EIS would not affect these two measures.

Based on a projection of the number of sets that will occur north of 23°N latitude, the costs of continuing to use current mitigation methods can be estimated for the Hawaii-based longline fleet (Table 4.8-2). Current mitigation methods do not entail any installation or set-up costs. Moreover, the costs of a line-shooter, weighted branch lines, and equipment required for handling of hooked seabirds should not be considered compliance costs, as these costs are routinely incurred by all Hawaii longline vessels targeting tuna. However, current mitigation methods do involve some annual costs. The fleet-wide annual cost of using blue-dyed bait is anticipated to be about $68,992, assuming a cost of $14 per set. This estimate likely overstates bait-related compliance costs because, as noted above, a number of vessels routinely dye a portion of their bait blue in order to increase its allure to target fish species.

Table 4.8-2 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB1, the No Action Alternative.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Predicted No. of Affected Vessels	Predicted No. of Affected Sets	Predicted Installation/ Set-up Costs	Predicted Annual Costs
Tuna	North of 23 °N	Current Methods	100	111	3,090	$0	$59,910
Swordfish	North of 23 °N	Current Methods	100	21	184	$0	$28,882
					Total	$0	$88,792

Based on the total number of predicted sets (14,285), the total number of active longline vessels is expected to be about 143, assuming a typical longline vessel makes 100 sets per year. Further, based on the number of predicted deep-sets (12,165) and shallow-sets (2,120), the number of tuna vessels and swordfish vessels is expected to be 121 and 21, respectively.

However, not all of these vessels may fish north of 23°N latitude. This analysis assumed that all 21 swordfish vessels fish north of 23°N latitude at least once a year, but only 111 (91%) of the 121 tuna boats fish above this latitude. The basis for this assumption is provided in Appendix D. The analysis further assumed that from year to year it will be the same vessels that restrict their fishing effort to grounds south of 23°N latitude. All vessels that fish north of 23°N latitude at least once would incur the costs of buying containers to store offal for discarding under Alternative SB1 (No Action). Assuming an annual cost of $150 per vessel for containers, the cost for all affected vessels is estimated to be about $19,800.

As shown in Table 4.8-2, the total annual compliance costs for the Hawaii-based longline fleet is estimated to be $88,792 under Alternative SB1 (No Action). These costs can be compared to an estimate of the fleet-wide annual costs. The cost-earnings study by O'Malley and Pooley (2003) described in Section 3.7.2.1 reports that the average annual total costs of operating a swordfish vessel and tuna vessel are about $462,000 and $441,000, respectively. Assuming a future affected fleet size of 111 tuna boats and 21 swordfish boats, the total annual costs of the fleet would be $59 million. The predicted annual costs of employing current seabird interaction mitigation methods represent a small fraction (about 0.15%) of the total annual costs.

As noted in Section 3.7.2.2.2, the compliance costs of current measures to mitigate seabird interactions are not evenly distributed across the fleet. In 2003, fishing grounds north of 23°N latitude accounted for 19% of the fishing effort of small vessels (<56 ft), 25% of the effort of medium vessels (56.1 ft-73.9 ft), and 30% of the effort of large vessels (>74 ft).Consequently, small vessels are expected to bear the lowest proportion of the predicted fleet-wide compliance costs under Alternative SB1 (No Action), and large vessels are anticipated to bear the highest share.

Up until April 2004, the only Hawaii limited entry longline permit holders affected by the seabird interaction mitigation measures were those making deep-sets, as shallow "swordfish-style" setting was prohibited to protect sea turtles. With the reopening of the swordfish-targeting segment of the Hawaii longline fishery under new regulations, it is anticipated that the impacts of employing the current methods to reduce seabird interactions will affect all vessels targeting swordfish. As indicated in Section 3.7.2.2.2, the fishing effort of swordfish vessels has historically been concentrated above 23°N latitude.

4.8.1.2 Alternative SB2A: Use either current methods or side-setting north of 23°N

In comparison to Alternative SB1 (No Action), this alternative is not expected to result in a significant change in the economic performance of the Hawaii-based longline fishery in terms of fleet size and composition, fishing trips, quantities produced, gross revenue or fishing costs.

However, by offering fishermen an option, this alternative provides regulated vessels greater flexibility to achieve the action objective in a more cost-effective way in comparison to Alternative SB1 (no Action) (i.e., fishermen can elect to maintain operating under the current suite of mitigation methods or use side-setting). Several vessels in the fleet have already converted to side-setting because of perceived operational benefits (beyond the minimization of bait theft and bird capture) (WPRFMC 2004c). Given the comparative benefits of side-setting versus current mitigation methods, it is likely that many, if not most, of the vessels in the Hawaii longline fleet would adopt side-setting as their interaction avoidance method of choice. By allowing vessel operators to choose between employing current mitigation methods or side-setting, this alternative addresses potential safety concerns associated with side-setting and recognizes that configuring some vessels for side-setting may be costly.

The estimated economic effects of side-setting are summarized in Table 3.7-9. All boats that choose side-setting would be required to employ a bird curtain, which Gilman et al.(2003) estimated to cost about $50. The bird curtain prevents birds from establishing a flight path along the side of the boat where baited hooks are deployed. In addition, all vessel would need to switch from 45 g to 60 g weighted swivels. The higher swivel weight is recommended by Gilman et al. to increase the bait sink rate, it is included as part of the definition of side-setting in the current BiOp for the shallow-set sector of the fishery (USFWS 2004a), and it is included as part of the standard definition of side-setting in this EIS. The cost of new swivels and crimps is about $2,500 (WPRFMC 2004c). It is estimated that about 70% of the longline vessels currently fishing in Hawaii already use 60 g weighted swivels (WPRFMC 2004c), with the remaining vessels using the required 45 g weight when deep-set fishing north of 23°N latitude.

Based on a projection of the number of sets that will occur north of 23°N latitude and an estimate of the percentage of vessels that would employ each of the available interaction avoidance method options, the costs of Alternative SB2A can be estimated for the Hawaii-based longline fleet (Table 4.8-3). The number of affected vessels and costs of current methods were estimated as in Alternative SB1 (No Action). The installation/set-up costs of side-setting is estimated to be about $4,000 for a typical vessel, including deck reconfiguration and new swivels and crimps (WPRFMC 2004c). (Many vessels will not need to purchase new swivels and crimps because they already use 60 g weighted swivels; on the other hand, the estimated reconfiguration costs do not include possible lost fishing time as a result of extra time spent in port during deck modifications.) In addition, each vessel employing side-setting would incur an annual cost of $50 to replace its bird curtain. As shown in Table 4.8-3, the predicted compliance costs for the longline fleet under Alternative SB2A include $476,000 for installation/set-up costs and $14,802 for annual costs. In comparison to Alternative SB1 (No Action), this represents a $476,000 increase in installation/set-up costs and a $73,990 decrease in annual costs.

Table 4.8-3 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB2A.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Predicted No. of Affected Vessels	Predicted No. of Affected Sets	Predicted Installation/ Set-up Costs	Predicted Annual Costs
Tuna	North of 23°N	Current Methods	10	11	309	$0	$5,976
		Side-setting	90	100	2781	$400,000	$5,000
Swordfish	North of 23°N	Current Methods	10	2	184	$0	$2,876
		Side-setting	90	19	1654	$76,000	$950
					Total	$476,000	$14,802
					Costs of Alternative SB1 (No Action) minus costs of this alternative	($476,000)	$73,990

4.8.1.3 Alternative SB2B: Use either current methods or side-setting in all areas

The economic effects of this alternative would be similar to those described under Alternative SB2A; the primary differences would be that some vessels that choose to use current methods will incur additional costs and those vessels that fish exclusively south of 23°N latitude would be affected by the regulations. As a result of these differences, the predicted compliance costs for the Hawaii-based longline fleet under Alternative SB2B include $516,000 for installation/set-up costs and $28,556 for annual costs (Table 4.8-4). In comparison to Alternative SB1 (No Action), this represents a $516,000 increase in installation/set-up costs and a $60,236 decrease in annual costs.

Table 4.8-4 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB2B.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	All	Current Methods	10	12	1,217	$0	$18,838
		Side-setting	90	110	10,948	$440,000	$5,500
Swordfish	All	Current Methods	10	2	212	$0	$3,268
		Side-setting	90	19	1,908	$76,000	$950
					Total	$516,000	$28,556
					Costs of Alternative SB1 (No Action) minus costs of this alternative	($516,000)	$60,236

4.8.1.4 Alternative SB3A: Use either current methods or underwater setting chute north of 23°N

In comparison to Alternative SB1 (No Action), this alternative is not expected to result in a significant change in the economic performance of the Hawaii-based longline fishery in terms of fleet size and composition, fishing trips, quantities produced, gross revenue or fishing costs.

However, by offering fishermen an option this alternative provides regulated vessels greater flexibility to achieve the action objective in a more cost-effective way in comparison to Alternative SB1 (No Action) (i.e., fishermen can elect to maintain operating under the current suite of mitigation methods or use an underwater setting chute). Given the comparative costs of the underwater setting chute versus current mitigation methods, it is likely that most of the Hawaii longline fleet would continue to choose to employ the current methods. By allowing vessel operators to choose between employing current mitigation methods or an underwater setting chute, this alternative addresses the high initial costs and potential operational difficulties associated with using underwater setting chutes.

The estimated economic effects of employing an underwater setting chute are summarized in Table 3.7-9. The Mustad funnel and Albi Save are two commercially available underwater setting devices. Both are large metal chutes attached to the stern, which deliver the line into the water up to 2 m below the surface. According to Gilman et al. (2003), the cost of the Mustad underwater setting funnel is $5,000 for the hardware. However, the underwater setting chute manufactured by Albi Save for use by pelagic longliners is about $2,500 (pers. comm., Eric Gilman, Blue Ocean Institute, 6/13/04). There is an additional cost associated with installation, and a chute may require periodic maintenance (pers. comm., Eric Gilman, Blue Ocean Institute, 6/13/04). Use of the underwater setting device is expected to increase fishing efficiency due to increased bait retention from avoiding bird interactions and mechanical effectiveness. But these positive effects would be offset to a degree by the slower hook setting rate in the tuna longline fishery compared to conventional setting (Gilman et al. 2003). The hook setting rate with the chute is expected to be suitable for the swordfish fishery where the conventional hook set interval is slower.

Based on a projection of the number of sets that will occur north of 23°N latitude and an estimate of the percentage of vessels that would employ each of the available interaction avoidance method options, the costs of Alternative SB3A can be estimated for the Hawaii-based longline fleet (Table 4.8-5). The number of affected vessels and costs of current methods were estimated as in Alternative SB1 (No Action). To be conservative (i.e., more likely to overstate impacts than understate them), this analysis assumed that the cost of an underwater setting funnel is $5,000. The life expectancy of an underwater setting chute is about 20 years (pers. comm., Eric Gilman, Blue Ocean Institute, 6/13/04). Based on a straight-line method of calculating depreciation, the annual cost for the chute is estimated to be about $250. The installation/set-up costs for an underwater setting chute are estimated to be about $1,000 for a typical vessel. As shown in Table 4.8-5, the predicted compliance costs for the Hawaii-based longline fleet under Alternative SB3A include $119,000 for installation/set-up costs and $38,602 for annual costs. In comparison to Alternative SB1 (No Action), this represents a $119,000 increase in installation/set-up costs and a $50,190 decrease in annual costs.

Table 4.8-5 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB3A.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	North of 23°N	Current Methods	10	11	309	$0	$5,976
		Underwater setting chute	90	100	2,781	$100,000	$25,000
Swordfish	North of 23°N	Current Methods	10	2	184	$0	$2,876
		Underwater setting chute	90	19	1,654	$19,000	$4,750
					Total	$119,000	$38,602
					Costs of Alternative SB1 (No Action) minus costs of this alternative	($119,000)	$50,190

4.8.1.5 Alternative SB3B: Use either current methods or underwater setting chute in all areas

The economic effects of this alternative would be similar to those described under Alternative SB3A; the primary differences would be that some vessels that choose to use current methods will incur additional costs and those vessels that fish exclusively south of 23°N latitude would be affected by the regulations. As a result of these differences, the predicted compliance costs for the Hawaii-based longline fleet under Alternative SB3B include $129,000 for installation/set-up costs and $54,356 for annual costs (Table 4.8-6). In comparison to Alternative SB1 (No Action), this represents a $129,000 increase in installation/set-up costs and a $34,436 decrease in annual costs.

Table 4.8-6 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB3B.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	All	Current Methods	10	12	1,217	$0	$18,838
		Underwater setting chute	90	110	10,948	$110,000	$27,500
Swordfish	All	Current Methods	10	2	212	$0	$3,268
		Underwater setting chute	90	19	1,908	$19,000	$4,750
					Total	$129,000	$54,356
					Costs of Alternative SB1 (No Action) minus costs of this alternative	($129,000)	$34,436

4.8.1.6 Alternative SB4A: Use either current methods or tori line north of 23°N

In comparison to Alternative SB1 (No Action), this alternative is not expected to result in a significant change in the economic performance of the Hawaii-based longline fishery in terms of fleet size and composition, fishing trips, quantities produced, gross revenue or fishing costs.

However, by offering fishermen an option this alternative provides regulated vessels greater flexibility to achieve the action objective in comparison to Alternative SB1 (No Action) (i.e., fishermen can elect to maintain operating under the current suite of mitigation methods or use a tori line). Given the comparative costs and benefits of tori lines versus current mitigation methods, it is likely that most of the Hawaii longline fleet would continue to choose to employ the current methods. According to WPRFMC (2004c), the cost of a tori line is about $2,000 for the fiberglass pole and $300 for the streamer line. However, McNamara et al. (1999) state that several on-board replacements may be required because of the high likelihood of breakage due to entanglements. While the costs of maintaining a supply of tori lines would represent a small fraction of the total annual operating costs of a Hawaii longline vessel, these additional costs and other factors are likely to create a disincentive for vessel owners to adopt this interaction avoidance method. By allowing vessel operators to choose between employing current mitigation methods or a tori line, this alternative addresses the potential costs and operational difficulties associated with using a tori line.

The estimated economic effects of employing a tori line are summarized in Table 3.7-9. Based on a projection of the number of sets that will occur north of 23°N latitude and an estimate of the percentage of vessels that would employ each of the available interaction avoidance method options, the costs of Alternative SB4A can be estimated for the Hawaii-based longline fleet (Table 4.8-7). The number of affected vessels and costs of current methods were estimated as in Alternative SB1 (No Action). The cost of a fiberglass pole with a streamer line was assumed to be $2,300. Because vessels may need to replace the pole due to breakage, the total annual costs were estimated to be $4,600. Installation of a mount for the tori line is expected to cost $1,000 (WPRFMC 2004c). As shown in Table 4.8-7, the predicted compliance costs for the Hawaii-based longline fleet under Alternative SB4A include $119,000 for installation/set-up costs and $556,252 for annual costs. In comparison to Alternative SB1 (No Action), this represents a $119,000 increase in installation/set-up costs and a $467,460 increase in annual costs.

Table 4.8-7 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB4A.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	North of 23°N	Current Methods	10	11	309	$0	$5,976
		Tori Line	90	100	2,781	$100,000	$460,000
Swordfish	North of 23°N	Current Methods	10	2	184	$0	$2,876
		Tori Line	90	19	1,654	$19,000	$87,400
					Total	$119,000	$556,252
Costs of Alternative SB1 (No Action) minus costs of this alternative						($119,000)	($467,460)

4.8.1.7 Alternative SB4B: Use either current methods or tori line in all areas

The economic effects of this alternative would be similar to those described under Alternative SB3A; the primary differences would be that some vessels that choose to use current methods will incur additional costs and those vessels that fish exclusively south of 23°N latitude would be affected by the regulations. As a result of these difference, the predicted compliance costs for the

Hawaii-based longline fleet under Alternative SB4B include $129,000 for installation/set-up costs and $615,506 for annual costs (Table 4.8-8). In comparison to Alternative SB1 (No Action), this represents a $129,000 increase in installation/set-up costs and a $526,714 increase in annual costs.

Table 4.8-8 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB4B.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	All	Current Methods	10	12	1,217	$0	$18,838
		Tori Line	90	110	10,948	$110,000	$506,000
Swordfish	All	Current Methods	10	2	212	$0	$3,268
		Tori Line	90	19	1,908	$19,000	$87,400
					Total	$129,000	$615,506
Costs of Alternative SB1 (No Action) minus costs of this alternative						($129,000)	($526,714)

<u>4.8.1.8 Alternative SB5A: Use either current methods or side-setting or underwater setting chute north of 23°N</u>

The economic effects of this alternative would be similar to those described for Alternatives SB2A and SB3A; the primary difference would be that this alternative would provide fishermen with even greater flexibility to achieve the action objective in a more cost-effective way (e.g., fishermen that have vessels unsuitable for side-setting may find the installation of an underwater setting chute to be cost-effective). The predicted compliance costs for the Hawaii-based longline fleet under Alternative SB5A include $437,000 for installation/set-up costs and $17,402 for annual costs (Table 4.8-9). In comparison to Alternative SB1 (No Action), this represents a $437,000 increase in installation/set-up costs and a $71,390 decrease in annual costs.

Table 4.8-9 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB5A.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	North of 23°N	Current Methods	10	11	309	$0	$5,976
		Side-setting	80	89	2,472	$356,000	$4,450
		Underwater setting chute	10	11	309	$11,000	$2,750
Swordfish	North of 23°N	Current Methods	10	2	184	$0	$2,876
		Side-setting	80	17	1,470	$68,000	$850
		Underwater setting chute	10	2	184	$2,000	$500
					Total	$437,000	$17,402
Costs of Alternative SB1 (No Action) minus costs of this alternative						($437,000)	$71,390

4.8.1.9 Alternative SB5B: Use either current methods or side-setting or underwater setting chute in all areas

The economic effects of this alternative would be similar to those described under Alternative SB3A; the primary differences would be that some vessels that choose to use current methods will incur additional costs and those vessels that fish exclusively south of 23°N latitude would be affected by the regulations. As a result of these differences, the predicted compliance costs for the Hawaii-based longline fleet under Alternative SB5B include $474,000 for installation/set-up costs and $31,356 for annual costs (Table 4.8-10). In comparison to Alternative SB1 (No Action), this represents a $474,000 increase in installation/set-up costs and a $57,436 decrease in annual costs.

Table 4.8-10 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB5B.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	All	Current Methods	10	12	1,217	$0	$18,838
		Side-setting	80	98	9,731	$392,000	$4,900
		Underwater setting chute	10	12	1,217	$12,000	$3,000
Swordfish	All	Current Methods	10	2	212	$0	$3,268
		Side-setting	80	17	1,696	$68,000	$850
		Underwater setting chute	10	2	212	$2,000	$500
					Total	$474,000	$31,356
					Costs of Alternative SB1 (No Action) minus costs of this alternative	($474,000)	$57,436

4.8.1.10 Alternative SB6A: Use either current methods or side-setting or underwater setting chute or tori line north of 23°N

The economic effects would be similar to those described for Alternative SB5A; the primary difference would be that this alternative would provide fishermen with even greater flexibility to achieve the regulatory objective in a more cost-effective way (e.g., fishermen that have vessels unsuitable for side-setting may find the installation of an underwater setting chute or use of a tori line to be cost-effective). The predicted compliance costs for the Hawaii-based longline fleet under Alternative SB6A include $398,000 for installation/set-up costs and $76,552 for annual costs (Table 4.8-11). In comparison to Alternative SB1 (No Action), this represents a $398,000 increase in installation/set-up costs and a $12,240 decrease in annual costs.

Table 4.8-11 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB6A.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	North of 23°N	Current Methods	10	11	309	$0	$5,976
		Side-setting	70	78	2,162	$312,000	$3,900
		Underwater setting chute	10	11	309	$11,000	$2,750
		Tori Line	10	11	309	$11,000	$50,600
Swordfish	North of 2 ˚N	Current Methods	10	2	184	$0	$2,876
		Side-setting	70	15	1,287	$60,000	$750
		Underwater setting chute	10	2	184	$2,000	$500
		Tori Line	10	2	184	$2,000	$9,200
					Total	$398,000	$76,552
					Costs of Alternative SB1 (No Action) minus costs of this alternative	($398,000)	$12,240

4.8.1.11 Alternative SB6B: Use either current methods or side-setting or underwater setting chute or tori line in all areas

The economic effects of this alternative would be similar to those described under Alternative SB6A; the primary differences would be that some vessels that choose to use current methods will incur additional costs and those vessels that fish exclusively south of 23°N would be affected by the regulations. As a result of these differences, the predicted compliance costs for the Hawaii-based longline fleet under Alternative SB6B include $428,000 for installation/set-up costs and $95,006 for annual costs (Table 4.8-12). In comparison to Alternative SB1 (No Action), this represents a $428,000 increase in installation/set-up costs and a $6,214 increase in annual costs.

Table 4.8-12 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB6B.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	All	Current Methods	10	12	1,217	$0	$18,838
		Side-setting	70	85	8,514	$340,000	$4,250
		Underwater setting chute	10	12	1,217	$12,000	$3,000
		Tori Line	10	12	1,217	$12,000	$55,200
Swordfish	All	Current Methods	10	2	212	$0	$3,268
		Side-setting	70	15	1,484	$60,000	$750
		Underwater setting chute	10	2	212	$2,000	$500
		Tori Line	10	2	212	$2,000	$9,200
					Total	$428,000	$95,006
					Costs of Alternative SB1 (No Action) minus costs of this alternative	($428,000)	($6,214)

4.8.1.12 Alternative SB7A: Use either current methods or side-setting or tori line north of 23°N

The economic effects would be similar to those described for Alternatives SB2A and SB4A; the primary difference would be that this alternative would provide fishermen with even greater flexibility to achieve the regulatory objective in a more cost-effective way (e.g., fishermen that have vessels unsuitable for side-setting may find the use of a tori line to be cost-effective). The predicted compliance costs for the Hawaii-based longline fleet under Alternative SB7A include $437,000 for installation/set-up costs and $73,952 for annual costs (Table 4.8-13). In comparison to Alternative SB1 (No Action), this represents a $437,000 increase in installation/set-up costs and a $14,842 decrease in annual costs.

Table 4.8-13 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB7A.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	North of 23°N	Current Methods	10	11	309	$0	$5,976
		Side-setting	80	89	2,472	$356,000	$4,450
		Tori Line	10	11	309	$11,000	$50,600
Swordfish	North of 23°N	Current Methods	10	2	184	$0	$2,876
		Side-setting	80	17	1,470	$68,000	$850
		Tori Line	10	2	184	$2,000	$9,200
					Total	$437,000	$73,952
Costs of Alternative SB1 (No Action) minus costs of this alternative						($437,000)	$14,840

4.8.1.13 Alternative SB7B: Use either current methods or side-setting or tori line in all areas

The economic effects of this alternative would be similar to those described under Alternative SB7A; the primary differences would be that some vessels that choose to use current methods will incur additional costs and those vessels that fish exclusively south of 23°N latitude would be affected by the regulations. As a result of these differences, the predicted compliance costs for the Hawaii-based longline fleet under Alternative SB7B include $474,000 for installation/set-up costs and $92,256 for annual costs (Table 4.8-14). In comparison to Alternative SB1 (No Action), this represents a $474,000 increase in installation/set-up costs and a $3,464 increase in annual costs.

Table 4.8-14 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB7B.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	All	Current Methods	10	12	1,217	$0	$18,838
		Side-setting	80	98	9,731	$392,000	$4,900
		Tori Line	10	12	1,217	$12,000	$55,200
Swordfish	All	Current Methods	10	2	212	$0	$3,268
		Side-setting	80	17	1,696	$68,000	$850
		Tori Line	10	2	212	$2,000	$9,200
					Total	$474,000	$92,256
Costs of Alternative SB1 (No Action) minus costs of this alternative						($474,000)	($3,464)

4.8.1.14 Alternative SB7C: For shallow-sets: use either current methods (without blue-dyed bait) or underwater setting chute or side-setting or tori line in all areas. For deep-sets: use either current methods (without blue-dyed bait) or underwater setting chute or side-setting or tori line north of 23°N

The economic effects of this alternative would be similar to those described for Alternative SB6A; the primary difference would be that those fishermen that choose to use the current mitigation methods would not incur the costs and operational difficulties of using blue-dyed bait. The predicted compliance costs for the Hawaii-based longline fleet under Alternative SB7C include $398,000 for installation/set-up costs and $69,650 for annual costs (Table 4.8-15). In comparison to Alternative SB1 (No Action), this represents a $398,000 increase in installation/set-up costs and a $19,142 decrease in annual costs.

Table 4.8-15 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB7C.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	North of 23°N	Current Methods wo/BDB	10	11	309	$0	$1,650
		Side-setting	70	78	2,163	$312,000	$3,900
		Underwater setting chute	10	11	309	$11,000	$2,750
		Tori Line	10	11	309	$11,000	$50,600
Swordfish	All	Current Methods wo/BDB	10	2	212	$0	$300
		Side-setting	70	15	1,484	$60,000	$750
		Underwater setting chute	10	2	212	$2,000	$500
		Tori Line	10	2	212	$2,000	$9,200
					Total	$398,000	$69,650
Costs of Alternative SB1 (No Action) minus costs of this alternative						($398,000)	$19,142

4.8.1.15 Alternative SB7D (Preferred Alternative): For shallow-sets: use either side-setting or current methods and tori lines in all areas. For deep-sets: use either side-setting or current methods and tori lines north of 23°N

For vessels targeting swordfish (shallow-setting) the economic effects of this alternative would be similar to those described under Alternative SB2B; the primary difference would be that those vessels that do not choose side-setting would incur the costs of both current methods and tori lines. For vessels targeting tuna (deep-setting) the economic effects of this alternative would be similar to those described under Alternative SB2A; as with swordfish vessels, the primary difference would be that those tuna vessels that do not choose side-setting would incur the costs of both current methods and tori lines. The predicted compliance costs for the Hawaii-based longline fleet under Alternative SB7D (Preferred Alternative) include $507,000 for installation/set-up costs and $43,154 for annual costs (Table 4.8-16). In comparison to Alternative SB1 (No Action), this represents a $507,000 increase in installation/set-up costs and a $45,638 decrease in annual costs.

Table 4.8-16 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB7D (Preferred Alternative).

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	North of 23°N	Current Methods and Tori Line	5	6	155	$,000	$30,670
		Side-setting	95	105	2937	$420,000	$5,250
Swordfish	North of 23°N	Current Methods and Tori Line	5	1	106	$1,000	$6,234
		Side-setting	95	20	2014	$80,000	$1,000
					Total	$507,000	$43,154
Costs of Alternative SB1 (No Action) minus costs of this alternative						($507,000)	$45,638

4.8.1.16 Alternative SB7E: For shallow-sets: use either side-setting or current methods and tori lines in all areas. For deep-sets: use either side-setting or current methods and tori lines north of 23°N. The requirement for blue dyed bait and offal discards is removed.

The economic effects of this alternative would be similar to those described for Alternative SB7D (Preferred Alternative); the primary difference would be that those fishermen that choose to use the current mitigation methods would not incur the costs and operational difficulties of using blue-dyed bait and strategic offal discards. The predicted compliance costs for the Hawaii-based longline fleet under Alternative SB7E include $489,000 for installation/set-up costs and $65,750 for annual costs (Table 4.8-17). In comparison to Alternative SB1(No Action), this represents a $489,000 increase in installation/set-up costs and a $23,042 decrease in annual costs.

Table 4.8-17 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB7E.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	North of 23 °˚N	Current Methods and Tori Line	10	11	309	$11,000	$50,600
		Side-setting	90	100	2,781	$400,000	$5,000
Swordfish	All	Current Methods and Tori Line	10	2	212	$2,000	$9,200
		Side-setting	90	19	1,908	$76,000	$950
					Total	$489,000	$65,750
Costs of Alternative SB1 (No Action) minus costs of this alternative						($489,000)	$23,042

4.8.1.17 Alternative SB8A: Use current mitigation methods plus side-setting north of 23°N

In comparison to Alternative SB1 (No Action), this alternative provides regulated vessels a similar lack of flexibility to achieve the regulatory objective in a cost-effective way. All interaction avoidance methods are non-discretionary. The annual operating costs of longline vessels would not increase significantly under this alternative. As noted in Section 4.8.1.2, however, reconfiguring some vessels for side-setting may be costly, although it is likely that side-setting can be feasibly employed on all vessels in the Hawaii-based longline fleet. Smaller vessels, in particular, may find it costly to convert to side-setting because of structural limitations.[47] The WPFMC has recommended that NMFS provide low-interest loans or State of Hawaii Fisheries Disaster Relief Program funds to fishermen to reduce these costs (WPFMC, 123rd Meeting, June 21-24, 2004). If implemented, this financial assistance would mitigate the unusually high costs that some vessels may incur when converting to side-setting.

Given the high likelihood that side-setting is feasible for all vessels in the longline fleet and the possibility of financial assistance to mitigate conversion costs, this analysis assumed that a requirement to side-set would not restrict fishing opportunities for any vessel north of 23°N latitude. The predicted compliance costs for the Hawaii-based longline fleet under Alternative SB8A include $528,000 for installation/set-up costs and $95,392 for annual costs (Table 4.8-18). In comparison to Alternative SB1 (No Action), this represents a $528,000 increase in installation/set-up costs and a $6,600 increase in annual costs. The negative economic impacts of this alternative would be higher if the requirement to side-set eliminates pelagic longlining opportunities north of 23°N latitude for vessels that can not be readily reconfigured for side-setting.

[47] The assertion by Gilman et al. (2003) that it is likely that there is no boat in the Hawaii-based longline fleet that can not be reconfigured for side-setting has recently been reiterated by an industry representative (pers. comm., Sean Martin, HLA, 11/08/04). This representative also expressed doubt that small vessels would find it more costly to convert to side-setting.

Table 4.8-18 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB8A.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	North of 23°N	Current Methods and Side-setting	100	111	3,090	$444,000	$65,460
Swordfish	North of 23°N	Current Methods and Side-setting	100	21	1,838	$84,000	$29,932
					Total	$528,000	$95,392
					Costs of Alternative SB1 (No Action) minus costs of this alternative	($528,000)	($6,600)

4.8.1.18 Alternative SB8B: Use current mitigation methods plus side-setting in all areas

The economic effects of this alternative would be similar to those described for Alternative SB8A; the primary difference would be that those vessels that fish exclusively south of 23°N latitude would be affected by the regulations.

Given the high likelihood that side-setting is feasible for all vessels in the longline fleet and the possibility of financial assistance to mitigate conversion costs, this analysis assumed that a requirement to side-set would not restrict fishing opportunities for any vessel. The predicted compliance costs for the Hawaii-based longline fleet under Alternative SB8B include $572,000 for installation/set-up costs and $228,590 for annual costs (Table 4.8-19). In comparison to Alternative SB1 (No Action), this represents a $572,000 increase in installation/set-up costs and a $139,798 increase in annual costs. The negative economic impacts of this alternative would be higher if the requirement to side-set eliminates pelagic longlining opportunities for vessels that can not be readily reconfigured for side-setting.

Table 4.8-19 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB8B.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	All	Current Methods and Side-setting	100	122	12,165	$488,000	$194,710
Swordfish	All	Current Methods and Side-setting	100	21	2,120	$84,000	$33,880
					Total	$572,000	$228,590
					Costs of Alternative SB1 (No Action) minus costs of this alternative	($572,000)	($139,798)

4.8.1.19 Alternative SB9A: Use side-setting north of 23°N

The economic effects of this alternative would be similar to those described for Alternative SB8A; the primary difference would be that fishermen would not incur the costs and operational difficulties of using the current mitigation methods. The predicted compliance costs for the

Hawaii-based longline fleet under Alternative SB9A include $528,000 for installation/set-up costs and $6,600 for annual costs (Table 4.8-20). In comparison to Alternative SB1 (No Action), this represents a $528,000 increase in installation/set-up costs and a $82,192 decrease in annual costs.

Table 4.8-20 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB9A.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	North of 23°N	Side-setting	100	111	3,090	$444,000	$5,550
Swordfish	North of 23°N	Side-setting	100	21	1,838	$84,000	$1,050
					Total	$528,000	$6,600
Costs of Alternative SB1 (No Action) minus costs of this alternative						($528,000)	$82,192

4.8.1.20 Alternative SB9B: Use side-setting in all areas

The economic effects of this alternative would be similar to those described for Alternative SB8B; the primary difference would be that fishermen would not incur the costs and operational difficulties of using the current mitigation methods. The predicted compliance costs for the Hawaii-based longline fleet under Alternative SB9B include $572,000 for installation/set-up costs and $7,150 for annual costs (Table 4.8-21). In comparison to Alternative SB1 (No Action), this represents a $572,000 increase in installation/set-up costs and a $81,642 decrease in annual costs.

Table 4.8-21 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB9B.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	All	Side-setting	100	122	12,165	$488,000	$6,100
Swordfish	All	Side-setting	100	21	2,120	$84,000	$1,050
					Total	$572,000	$7,150
Costs of Alternative SB1 (No Action) minus costs of this alternative						($572,000)	$81,642

4.8.1.21 Alternative SB10A: Use side-setting unless technically infeasible; in which case use current methods north of 23°N

The economic effects of this alternative would be similar to those described for Alternative SB2A As noted in Section 4.8.1.2, it is likely that side-setting can be employed on all vessels in the Hawaii longline fleet (Gilman et al., 2003); however, reconfiguring some vessels for side-setting may be especially costly. Consequently, this analysis assumed that 5% of the active longline vessels would choose to use the current methods. The predicted compliance costs for the Hawaii-based longline fleet under Alternative SB10A include $500,000 for installation/set-up costs and $10,758 for annual costs (Table 4.8-22). In comparison to Alternative SB1 (No Action), this represents a $500,000 increase in installation/set-up costs and a $78,034 decrease in annual costs.

Table 4.8-22 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB10A.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	North of 23°N	Side-setting	95	105	2,935	$420,000	$5,250
		Current Methods	5	6	155	$0	$3,070
Swordfish	North of 23°N	Side-setting	95	20	1,746	$80,000	$1,000
		Current Methods	5	1	92	$0	$1,438
					Total	$500,000	$10,758
					Costs of Alternative SB1 (No Action) minus costs of this alternative	($500,000)	$78,034

4.8.1.22 Alternative SB10B: Use side-setting unless technically infeasible; in which case use current methods in all areas

The economic effects of this alternative would be similar to those described for Alternative SB2B. The predicted compliance costs for the Hawaii-based longline fleet under Alternative SB10B include $544,000 for installation/set-up costs and $17,846 for annual costs (Table 4.8-23). In comparison to Alternative SB1 (No Action), this represents a $544,000 increase in installation/set-up costs and a $70,946 decrease in annual costs.

Table 4.8-23 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB10B.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	All	Side-setting	95	116	11,557	$464,000	$5,800
		Current Methods	5	6	608	$0	$9,412
Swordfish	All	Side-setting	95	20	2,014	$80,000	$1,000
		Current Methods	5	1	106	$0	$1,634
					Total	$544,000	$17,846
					Costs of Alternative SB1 (No Action) minus costs of this alternative	($544,000)	$70,946

4.8.1.23 Alternative SB11A: Use side-setting unless technically infeasible, in which case use an underwater setting chute or a tori line or current measures without blue bait or strategic offal discards (shallow-setting vessels set at night, deep-setting vessels use line-shooters with weighted branch lines), when fishing north of 23°N

The economic effects of this alternative would be similar to those described for Alternative SB6A; the primary difference would be that those fishermen that choose to use the current mitigation methods would not incur the costs and operational difficulties of using blue-dyed bait and strategic offal discards. The predicted compliance costs for the Hawaii-based longline fleet under Alternative SB11A include $503,000 for installation/set-up costs and $15,700 for annual costs (Table 4.8-24). In comparison to Alternative SB1 (No Action), this represents a $503,000 increase in installation/set-up costs and a $73,092 decrease in annual costs.

Table 4.8-24 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB11A.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	North of 23°N	Side-setting	95	105	2,935	$420,000	$5,250
		Current Methods wo/BDB&SOD	2	2	62	$0	$0
		Underwater setting chute	1	1	31	$1,000	$250
		Tori Line	2	2	62	$2,000	$9,200
Swordfish	North of 23°N	Side-setting	95	20	1,746	$80,000	$1,000
		Current Methods wo/BDB&SOD[1]	2	0	37	$0	$0
		Underwater setting chute[1]	1	0	18	$0	$0
		Tori Line[1]	2	0	37	$0	$0
					Total	$503,000	$15,700
					Costs of Alternative SB1 (No Action) minus costs of this alternative	($503,000)	$73,092

[1]The number of vessels that choose this mitigation method is too small to calculate compliance costs.

4.8.1.24 Alternative SB11B: Use side-setting unless technically infeasible, in which case use an underwater setting chute or a tori line or current measures without blue bait or strategic offal discards (shallow-setting vessels set at night, deep-setting vessels use line-shooters with weighted branch lines), in all areas

The economic effects of this alternative would be similar to those described for Alternative SB6B; the primary differences would be that those fishermen that choose to use the current mitigation methods would not incur the costs and operational difficulties of using blue-dyed bait and strategic offal discards. The predicted compliance costs for the Hawaii-based longline fleet under Alternative SB11B include $547,000 for installation/set-up costs and $16,250 for annual costs (Table 4.8-25). In comparison to Alternative SB1 (No Action), this represents a $547,000 increase in installation/set-up costs and a $72,540 decrease in annual costs.

Table 4.8-25 Predicted Costs of Mitigation Methods to Reduce Seabird Interactions in the Hawaii-based Longline Fishery Under Alternative SB11B.

Vessel Type	Area Where Mitigation Method Applies	Mitigation Method	Percentage of Vessels Choosing Mitigation Method	Projected No. of Affected Vessels	Projected No. of Affected Sets	Projected Installation/ Set-up Costs	Projected Annual Costs
Tuna	All	Side-setting	95	116	11,558	$464,000	$5,800
		Current Methods wo/BDB&SOD	2	2	243	$0	$0
		Underwater setting chute	1	1	122	$1,000	$250
		Tori Line	2	2	243	$2,000	$9,200
Swordfish	All	Side-setting	95	20	2,014	$80,000	$1,000
		Current Methods wo/BDB&SOD[1]	2	0	42	$0	$0
		Underwater setting chute[1]	1	0	21	$0	$0
		Tori Line[1]	2	0	42	$0	$0
Total						$547,000	$16,250
Costs of Alternative SB1 (No Action) minus costs of this alternative						($547,000)	$72,542

[1]The number of vessels that choose this mitigation method is too small to calculate compliance costs.

4.8.1.25 Alternative SB12: Voluntarily use night-setting or underwater setting chute or tori line or line-shooter with weighted branch lines south of 23°N

The economic effects of this alternative would be similar to those described for Alternative SB1 (No Action). It is unlikely that any fishing enterprises that experience significant negative economic effects from the use of voluntary seabird interaction avoidance methods would continue to employ those methods. Given the costs and operational difficulties of using an underwater chute or tori line, it is unlikely that many, if any, vessels would voluntarily adopt these interaction avoidance methods. Vessels that do not already use night-setting would likely be hesitant to adopt this fishing practice because of concerns that it would decrease catch rates of certain target species and could be dangerous if vessels are not suitably equipped. Most longline vessels fishing south of 23°N latitude already use a line-shooter with weighted branch lines, as this gear increases the speed at which the mainline is set, thereby causing the mainline to sag in the middle and allowing the middle hooks to fish deeper. Vessels that do not already use a line-shooter with weighted branch lines are unlikely to voluntarily adopt this gear solely for the purpose of reducing seabird interactions because of the high costs of the gear.

4.8.2 Squid Jig Fishery Management Measures

4.8.2.1 Alternative SQA.1: No Action

Sec. 2(a)(8) of the MSA states that the collection of reliable data is essential to the effective conservation, management, and scientific understanding of the fishery resources of the U.S.. Under the No Action Alternative for Sub-objective A, there would be no short term economic impacts on participants in the squid fisheries within the authority of the WPFMC. The short-term economic performance of the squid fisheries in terms of fleet size and composition, fishing trips, quantities produced, gross revenue and fishing costs is expected to continue as described in Section 3.7.

4.8.2.2 Alternative SQA.2: Voluntary Monitoring

In comparison to Alternative SQA.1 (Sub-objective A No Action), this alternative is not expected to result in a significant change in the economic performance of squid fisheries within the jurisdiction of the WPFMC in terms of fleet size and composition, fishing trips, quantities produced, gross revenue or fishing costs.

Under this alternative the additional regulatory costs to the fishing industry are zero; vessels that do not wish to accept NMFS observers or use logbooks designed specifically for use by domestic pelagic squid vessels would not be required to do so.

4.8.2.3 Alternative SQA.3 (Sub-objective A Preferred Alternative): Mandatory Monitoring and Management through the Pelagics FMP

In comparison to Alternative SQA.1 (Sub-objective A No Action), this alternative is not expected to result in a significant change in the short term economic performance of squid fisheries within the jurisdiction of the WPFMC in terms of fleet size and composition, fishing trips, quantities produced, gross revenue or fishing costs. A positive impact of recordkeeping and reporting requirements on participants in the squid fisheries is that they may contribute data to help assess the current stock condition of target species, thereby assisting in the effective long-term management of the fisheries.

The burden for recordkeeping and reporting requirements include the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. U.S. vessels fishing on the high seas are currently subject to reporting requirements under the HSFCA. The operator of a vessel with a HSFCA permit (OMB No. 0648-0304) must report identification information for vessel and operator; operator signature; crew size; whether an observer is aboard; target species; gear used; dates, times, locations, and conditions under which fishing was conducted; species and amounts of fish retained and discarded; and details of any interactions with sea turtles or birds (OMB No. 0648-0349) (50 CFR 300.17(a)). Similarly, vessels fishing in the U.S. EEZ may already be subject to state or other reporting requirements. For example, vessel operators holding a HDAR commercial marine license must submit a monthly report with respect to marine life taken and any bait used. For vessels fishing on the high seas or in the EEZ the incremental reporting costs associated with using a logbook specifically designed for squid harvesting are expected to be minimal.[48]

Should the use of electronic logbooks be required, in which vessels would be required to submit catch reports via e-mail or direct from a modem from a computer on board, vessels may incur an added cost and require initial training (the one company engaging in distant-water squid fisheries

[48] Except for certain fisheries, the HSFCA requires a permit holder to report high seas catch and effort by maintaining and submitting records, specific to the fishing gear being used, on forms provided by the Regional Administrator of the NMFS Region which issued the permit holder's HSFCA permit (50 CFR 300.17(b)(3)).

in the Pacific Ocean reportedly already uses a custom electronic logbook system; therefore, the costs of a mandatory electronic logbook system to this firm are likely to be negligible). Electronic logbooks can benefit fishermen by making the reporting process simpler and more accurate.

The inclusion of pelagic squid in the Council's existing Pelagics FMP would not in itself result in additional regulatory costs for participants in the fisheries. A potential positive effect of inclusion of pelagic squid in the FMP may be the facilitation of effective management of squid fisheries, thereby helping ensure their long term sustainability. The guidelines for FMPs published by NMFS require that a stock assessment and fishery evaluation (SAFE) report be prepared and reviewed annually for each FMP (50 CFR 602). The SAFE reports are intended to summarize the best available scientific information concerning the past, present and future condition of the stocks, marine ecosystems, and fisheries under federal management. This information forms the basis for establishing measures applicable to the fishery which are necessary and appropriate for the conservation and management of the fishery resource involved.

This analysis assumes that the costs of deploying observers will be paid by NMFS. However, even if the direct costs of observer coverage are paid by NMFS, vessels may incur some indirect costs. Limited bunk space may require vessel operators to reduce the number of crew in order to accommodate observers, resulting in a decrease in the operating efficiency of the remaining crew. Vessels may also incur costs if they choose to carry additional liability insurance. These costs would vary between individual vessels depending on the insurance carriers' minimum allowed coverage period, and the coverage approach that is taken.

4.8.2.4 Alternative SQA.4: Mandatory Monitoring and Management through a New Squid FMP

The effects would be similar to those described for Alternative SQA.3 (Sub-objective A Preferred Alternative).

4.8.2.5 Alternative SQA.5: Mandatory Monitoring and Management through International Agreement

This alternative would have the potential for positive impacts on participants in squid fisheries by establishing domestic and/or international mechanisms to quickly implement regulatory controls, should such management become necessary.

4.8.2.6 Alternative SQB.1: Sub-objective B No Action

The effects would be similar to those described for Alternative SQA.1 (Sub-objective A No Action).

4.8.2.7 Alternative SQB.2: Cease Issuing HSFCA Permits

Under the HSFCA, vessels fishing on the high seas must obtain a HSFCA permit. This alternative would eliminate permitting of vessels in the high seas domestic squid fishery, thereby effectively closing the fishery.

One company is currently engaged in distant-water squid fisheries in the Pacific Ocean. During part of the year the operation fishes on the high seas north of the Hawaiian Archipelago. In addition, during part of the year the operation fishes in the New Zealand EEZ where it operates under charter to a New Zealand owned company. The proportion of the operation's total revenue derived from fishing on the high seas is unknown. However, it is likely that the elimination of the high seas fishery would have a significant adverse impact on the economic viability of the firm. The company would have to concentrate their fishing activities in squid fisheries occurring inside the U.S. EEZ or the EEZ of another nation, shift to fisheries on other stocks or tie up their vessels.

The ability of the company to recover the revenue previously generated from the high seas fishery by shifting to alternative squid fisheries in the U.S. EEZ or another nation's EEZ may be limited. As noted in Section 3.7, a moratorium has been placed on the number of vessels in the California fishery for *L. opalescens*, and both the *L. pealei* and *I. illecebrosus* fisheries off the East Coast are managed under limited entry programs. Neither of these fisheries is a jig fishery. The major squid fisheries occurring in the EEZs of other nations tend be highly competitive, with participation by fleets from several countries, and the license fees to acquire access to the more productive fisheries can be high. Moreover, the abundance of squid in the EEZ of any particular country tends to be highly variable from year to year.

As discussed in Section 3.7, the four catcher boats of the company currently fishing on the high seas are converted crab boats from Alaska. Fitting out the vessels for squid fishing was costly (the least expensive boat was $1.2 million) because of the need to install blast freezers aboard each boat. Refitting the boats for crab fishing may be prohibitively expensive. Furthermore, the Alaska crab fisheries are over-capitalized; NMFS is currently implementing a $100 million vessel buyback program for the Bering Sea/Aleutian Islands king and tanner crab fishery. Given that opportunities for the company to recover its lost harvest and income are likely to be limited should the high seas squid fishery be closed, it is probable that the firm would be forced to sell out. It is uncertain how active the nationwide or international market is for the types of vessels, gear and other investment capital employed by the firm. If the immediate resale market for these assets is small, the vessel owners would experience a significant economic hardship. Unemployed crew members would also suffer from a loss of income; the ability of these individuals to find suitable alternative employment is unknown. Based on the vessel crew sizes presented in Section 3.7, it is estimated that about 54 individuals would be affected.

This alternative would also foreclose the option for any other domestic fishing enterprise to pursue a high seas squid fishery in the future, although it is unlikely that a large number of U.S. vessels would choose this option given the fact that the fishery is unfamiliar to most fishermen in the U.S. and that entry into the fishery requires substantial specialized capital investment.

4.8.2.8 Alternative SQB.3: Voluntary Monitoring

The effects would be similar to those described for Alternative SQA.2.

4.8.2.9 Alternative SQB.4 (Sub-objective B Preferred Alternative): Mandatory Monitoring through New Logbooks

In comparison to Alternative SQA.1 (Sub-objective A No Action), this alternative is not expected to result in a significant change in the short term economic performance of squid fisheries within the jurisdiction of the WPFMC in terms of fleet size and composition, fishing trips, quantities produced, gross revenue or fishing costs. A positive impact of recordkeeping and reporting requirements on participants in the squid fisheries is that they may provide sufficient data to assess the current stock condition of target species, thereby assisting in the effective long term management of the fisheries.

The burden for recordkeeping and reporting requirements include the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. U.S. vessels fishing on the high seas are currently subject to reporting requirements under the HSFCA, The operator of a vessel with a HSFCA permit must report identification information for vessel and operator; operator signature; crew size; whether an observer is aboard; target species; gear used; dates, times, locations, and conditions under which fishing was conducted; species and amounts of fish retained and discarded; and details of any interactions with sea turtles or birds (50 CFR 300.17(a)). For vessels fishing on the high seas the incremental reporting costs associated with using a logbook specifically designed for squid harvesting are expected to be minimal.[49]

Should the use of electronic logbooks be required, in which vessels would be required to submit catch reports via e-mail or direct from a modem from a computer on board, vessels may incur an added cost and require initial training (the one company currently engaged in fishing for squid on the high seas in the Pacific Ocean reportedly already uses a custom electronic logbook system; therefore, the costs of a mandatory electronic logbook system to this firm are likely to be negligible).

This analysis assumes that the costs of deploying observers will be paid by NMFS. However, even if the direct costs of observer coverage are paid by NMFS, vessels may incur some indirect costs. Limited bunk space may require vessel operators to reduce the number of crew in order to accommodate observers, resulting in a decrease in the operating efficiency of the remaining crew. Vessels may also incur costs if they choose to carry additional liability insurance. These costs would vary between individual vessels depending on the insurance carriers' minimum allowed coverage period, and the coverage approach that is taken

4.8.2.10 Alternative SQB.5: Mandatory Monitoring and Management through FMPs

The effects would be similar to those described for Alternative SQA.3 (Sub-objective A Preferred Alternative).

[49] Except for certain fisheries, the HSFCA requires a permit holder to report high seas catch and effort by maintaining and submitting records, specific to the fishing gear being used, on forms provided by the Regional Administrator of the NMFS Region which issued the permit holder's HSFCA permit (50 CFR 300.17(b)(3)).

4.8.2.11 Alternative SQB.6: Mandatory Monitoring and Management through International Agreement.

The effects would be similar to those described for Alternative SQA.1 (Sub-objective A No Action) and SQB.1 (Sub-objective B No Action).

4.9 Social Impacts

This analysis examines the following three types of potential social impacts for each alternative:

- Sustained participation of fishing communities. An analysis of these impacts is consistent with the MSA and National Standard 8. The focus is on those socioeconomic impacts that follow from the links between fishing sectors and communities.
- Group and cultural issues. This portion of the analysis is intended to identify specific social groups and cultural factors with the potential to be adversely impacted in ways that may be substantially different from those seen at the level of the community as a whole or are not captured in an analysis of sustained community participation.
- Environmental justice issues. An analysis of these issues is consistent with EO 12898. The objective is to identify potential disproportionately high and adverse impacts to minority populations or low income populations.

4.9.1 Seabird Interaction Avoidance Measures

4.9.1.1 Alternative SB1: No Action

4.9.1.1.1 Sustained Participation of Fishing Communities

Oahu is the relevant fishing community to assess in this EIS with respect to seabird interaction measures, as it the home port for nearly the entire Hawaii-based longline fleet. Other fishing communities in Hawaii and the fishing communities of American Samoa, Guam and Northern Mariana Islands would not be affected by any of the alternatives considered. Fishing vessels and seafood processors based in those communities would not benefit from the alternatives, nor would they experience any adverse effects.

Under the No Action Alternative the sustained participation of Oahu in the Hawaii longline fishery would be unaffected. and Oahu would continue to benefit from the fishery as described in Sections 3.7 and 3.8.

4.9.1.1.2 Group and Cultural Issues

One group that may be negatively affected by the No Action Alternative are those members of the general public who are concerned about protected species issues and protection of seabirds. In recent years, seabird mortality in longline fisheries worldwide has been the subject of considerable concern to various environmental advocacy groups. Moreover, it is likely that some members of the general public ascribe the same high value to preserving the short-tailed albatross and other seabirds that they assign to the preservation of other endangered “charismatic megafauna.” The reopening of the swordfish-targeting segment of the Hawaii longline fishery is likely to increase public concern, as the problem of incidental seabird catch in the Hawaii pelagic longline fishery historically occurred mainly among those fishing vessels targeting swordfish or a mixture of swordfish and tuna in the U.S. EEZ and on the high seas adjacent to the NWHI. A perception of no action, as implied by the title of th alternative, however, belies the implementation of current seabird interaction avoidance measures now required in the shallow-set sector of the fleet. These measures are projected to have a combined efficacy similar to that demonstrated in the deep-set sector of the fishery, where interactions were reduced by an order of magnitude after their implementation.

4.9.1.1.3 Environmental Justice

With the reopening of the swordfish-targeting segment of the Hawaii longline fishery, the current measures to reduce seabird interactions are anticipated to affect all swordfish vessels, as the fishing effort of these vessels has historically been concentrated above 23°N latitude, the fishing area in which the use of the current methods is required. Prior to the closure of the swordfish portion of the Hawaii longline fishery in 2001, swordfish-targeting vessels were closely associated with a single ethnic or sociocultural group—Vietnamese Americans. As indicated in Section 3.8, nearly all of the owners and captains of swordfish vessels belonged to this ethnic group. However, under the regulations for the newly re-opened swordfish component of the Hawaii longline fishery, the annual effort limit of 2,120 swordfish sets is divided and distributed each calendar year in equal portions (in the form of transferable single-set certificates valid for a single calendar year) to all holders of Hawaii longline limited entry permits that provide written notice to NMFS no later than November 1 prior to the start of the calendar year of their interest in receiving such certificates (for the 2004 fishing year the deadline was May 1, 2004). The discussion in Section 3.8 also noted that about two-thirds of the 164 Hawaii longline limited entry permit holders requested and received shallow-set certificates for 2004. Many of those receiving certificates are permit holders who currently own vessels categorized as swordfish boats in 1999 and are likely of Vietnamese ancestry. However, many permit holders who currently own vessels categorized as tuna boats in 1999 also received certificates. The majority of these boat owners are of European or Korean descent. Consequently, it is uncertain if the swordfish-targeting portion of the Hawaii longline fleet that develops will be closely associated with Vietnamese Americans or any other single ethnic or sociocultural group.

Even if the current measures to reduce seabird interactions would affect a disproportionate number of vessels owned and operated by a particular minority group, the economic impact of these measures on individual fishing enterprises would not likely be significant. The required use of strategic offal discharge, and thawed, blue dyed bait have a negligible impact on catch rates, and the direct cost of employing these interaction avoidance methods is small. Vessels targeting tuna routinely use a line-shooter and weighted branch lines. Vessels targeting swordfish routinely set at night; however, the requirement to begin setting the longline at least one hour after local sunset and complete the setting process by local sunrise could potentially have a negative effect on catch rates. Some fishermen claim that hooks set before dusk are more effective. Moreover, the night-setting requirement may provide less setting time for vessels fishing at high latitudes during summer months. While there is insufficient information to quantify these effects on catch rates, the impact on the overall economic performance of individual fishing enterprises is expected to be low. Therefore, it is unlikely that this alternative would have environmental justice implications for minority populations or low-income populations.

4.9.1.2 Alternative SB2A: Use either current methods or side-setting north of 23°N

4.9.1.2.1 Sustained Participation of Fishing Communities

Impacts would be similar to those under Alternative SB1 (No Action). The sustained participation of MSA fishing communities in Western Pacific pelagic fisheries would be unaffected.

4.9.1.2.2 Group and Cultural Issues

By taking action to further reduce the number of seabird interactions in the Hawaii-based longline fishery, this alternative further allays public concerns about the negative effects that the incidental mortality of seabirds in the fishery may have on seabird populations. Additional benefits will accrue to members of the general public who value the protection of seabirds if the interaction avoidance methods are transferred successfully to other U.S. longline fleets and to foreign longline fleets.

4.9.1.2.3 Environmental Justice

This alternative would have no environmental justice implications for minority populations or low-income populations.

4.9.1.3 Alternative SB2B: Use either current methods or side-setting in all areas

4.9.1.3.1 Sustained Participation of Fishing Communities

Impacts would be similar to those under Alternative SB1 (No Action). The sustained participation of MSA fishing communities in Western Pacific pelagic fisheries would be unaffected.

4.9.1.3.2 Group and Cultural Issues

By taking action to further reduce the number of seabird interactions in the Hawaii-based longline fishery, this alternative further allays public concerns about the negative effects that the incidental mortality of seabirds in the fishery may have on seabird populations. Additional benefits will accrue to members of the general public who value the protection of seabirds if the interaction avoidance methods are transferred successfully to other U.S. longline fleets and to foreign longline fleets.

4.9.1.3.3 Environmental Justice

This alternative could potentially have disproportionately high impacts to a minority population in Hawaii. In 2003, fishing grounds south of 23°N latitude accounted for 81% of the fishing effort (sets) of small vessels, 75% of the effort of medium vessels, and 70% of the effort of large vessels. Data presented in Section 3.8 indicate that about two-thirds of the small (<56 ft) vessels in the Hawaii-based longline fleet are owned by individuals of Korean descent. A representative of the Korean Longline Association confirmed that the members of his organization fish primarily south of 23°N latitude (pers. comm., Karla Gore, NMFS Pacific Islands Fisheries Regional Office, 4/28/04).

However, even if extending current methods to reduce seabird interactions to fishing grounds south of 23°N latitude would affect a disproportionate number of vessels owned and operated by a particular minority group, the economic impacts would likely not be significant. As noted in Section 4.9.1.1.3, the current measures have a minimal economic or social effect on fishing enterprises. Therefore, it is unlikely that this alternative would have significant environmental justice implications for minority populations or low-income populations.

4.9.1.4 Alternative SB3A: Use either current methods or underwater setting chute north of 23°N

The social effects would be similar to those described for Alternative SB2A.

4.9.1.5 Alternative SB3B: Use either current methods or underwater settingchute in all areas

The social effects would be similar to those described for Alternative SB2B.

4.9.1.6 Alternative SB4A: Use either current methods or tori line north of 23°N

The social effects would be similar to those described for Alternative SB2A.

4.9.1.7 Alternative SB4B: Use either current methods or tori line in all areas

The social effects would be similar to those described for Alternative SB2B.

4.9.1.8 Alternative SB5A: Use either current methods or side-setting or underwater setting chute north of 23°N

The social effects would be similar to those described for Alternative SB2A.

4.9.1.9 Alternative SB5B: Use either current methods or side-setting or underwater setting chute in all areas

The social effects would be similar to those described for Alternative SB2B.

4.9.1.10 Alternative SB6A: Use either current methods or side-setting or underwater setting chute or tori line north of 23°N

The social effects would be similar to those described for Alternative SB2A.

4.9.1.11 Alternative SB6B: Use either current methods or side-setting or underwater setting chute or tori line in all areas

The social effects would be similar to those described for Alternative SB2B.

4.9.1.12 Alternative SB7A: Use either current measures or side-setting or tori line north of 23°N

The social effects would be similar to those described for Alternative SB2A.

4.9.1.13 Alternative SB7B: Use either current measures or side-setting or tori line in all areas

The social effects would be similar to those described for Alternative SB2B.

4.9.1.14 Alternative SB7C: For shallow-sets: use either current measures (without blue-dyed bait) or underwater setting chute or side-setting or tori line in all areas. For deep-sets: use either current measures (without blue-dyed bait) or underwater setting chute or side-setting or tori line north of 23°N

The social effects would be similar to those described for Alternative SB2A; the primary difference would be that those vessels that choose to use current measures would not incur the costs and operational difficulties of using blue-dyed bait.

4.9.1.15 Alternative SB7D (Preferred Alternative): For shallow-sets: use either side-setting or current methods and tori lines in all areas. For deep-sets: use either side-setting or current methods and tori lines north of 23 N.

For vessels targeting swordfish (shallow-setting) the social effects of this alternative would be similar to those described under Alternative SB2B; the primary difference would be that those vessels that do not choose side-setting would incur the costs of both current methods and tori lines. For vessels targeting tuna (deep-setting) the social effects of this alternative would be similar to those described under Alternative SB2A; as with swordfish vessels, the primary difference would be that those tuna vessels that do not choose side-setting would incur the costs of both current methods and tori lines.

As in Alternative SB2B, extending measures to reduce seabird interactions to fishing grounds south of 23°N latitude may affect a disproportionate number of vessels owned and operated by a particular minority group. However, the economic impacts would likely not be significant. As noted in Sections 4.8.1.1 and 4.8.1.6, the current measures and tori lines are likely to have a minimal economic effect on the overall operating costs of fishing enterprises. As discussed in Section 4.8.1.2, the conversion to side-setting may be costly for some vessels. Small longliners, in particular, may not be readily reconfigured for side-setting, although it is likely that side-setting can be feasibly employed on all vessels in the Hawaii-based longline fleet. This alternative provides fishermen with an option if they believe converting to side-setting would be too expensive. Therefore, it is unlikely that this alternative has significant environmental justice implications for minority populations or low-income populations.

4.9.1.16 Alternative SB7E: For shallow-sets: use either side-setting or current methods and tori lines in all areas. For deep-sets: use either side-setting or current methods and tori lines north of 23°N. The requirement for blue dyed bait and offal discards is removed.

The social effects of this alternative would be similar to those described for Alternative SB7D (Preferred Alternative); the primary difference would be that those fishermen that choose to use the current mitigation methods would not incur the costs and operational difficulties of using blue-dyed bait and strategic offal discards.

4.9.1.17 Alternative SB8A: Use current mitigation measures plus side-setting north of 23°N

The social effects would be similar to those described for Alternative SB2B. As in Alternative SB2B, extending measures to reduce seabird interactions to fishing grounds south of 23°N latitude may affect a disproportionate number of vessels owned and operated by a particular minority group. As discussed in Section 4.8.1.2, the conversion to side-setting may be costly for some vessels. Small longliners, in particular, may not be readily reconfigured for side-setting, although it is likely that side-setting can be feasibly employed on all vessels in the Hawaii-based longline fleet.[50] Data presented in Section 3.8 indicate that about two-thirds of the small (<56 ft) vessels in the Hawaii-based longline fleet are owned by individuals of Korean descent.

The WPFMC has recommended that NMFS provide low-interest loans or State of Hawaii Fisheries Disaster Relief Program funds to fishermen to reduce the costs of converting to side-setting (WPFMC, 123rd Meeting, June 21-24, 2004). If implemented, this financial assistance would mitigate the unusually high costs that some vessels may incur when converting to side-setting. Given the high likelihood that side-setting is feasible for all vessels in the longline fleet and the possibility of financial assistance to mitigate conversion costs, it is likely that a requirement to side-set would not restrict fishing opportunities for any vessel. Therefore, it is unlikely that this alternative would have significant environmental justice implications for minority populations or low-income populations.

4.9.1.18 Alternative SB8B: Use current mitigation measures plus side-setting in all areas

The economic effects of this alternative would be similar to those described for Alternative SB8A; the primary difference would be that those vessels that fish exclusively south of 23°N latitude would be affected by the regulations. As with Alternative SB8A, it is it is likely that Alternative SB8B would not restrict fishing opportunities for any vessel. Therefore, it is unlikely that this alternative would have significant environmental justice implications for minority populations or low-income populations.

4.9.1.19 Alternative SB9A: Use side-setting north of 23°N

The social effects would be similar to those described for Alternative SB8A; the primary difference would be that fishermen would avoid the costs and operational difficulties of using current mitigation methods.

[50] The assertion by Gilman et al. (2003) that it is likely that there is no boat in the Hawaii-based longline fleet that can not be reconfigured for side-setting has recently been reiterated by an industry representative (pers. comm., Sean Martin, HLA, 11/08/04). This representative also expressed doubt that small vessels would find it more costly to convert to side-setting.

4.9.1.20 Alternative SB9B: Use side-setting in all areas

The social effects would be similar to those described for Alternative SB8B; the primary difference would be that fishermen would avoid the costs and operational difficulties of using current mitigation methods.

4.9.1.21 Alternative SB10A: Use side-setting unless technically infeasible; in which case use current measures north of 23°N

The social effects of this alternative would be similar to those described for Alternative SB2A

4.9.1.22 Alternative SB10B: Use side-setting unless technically infeasible; in which case use current measures in all areas

The social effects of this alternative would be similar to those described for Alternative SB2B

4.9.1.23 Alternative SB11A: Use side-setting unless technically infeasible, in which case use an underwater setting chute or a tori line or current measures without blue bait or strategic offal discards (shallow-setting vessels set at night, deep-setting vessels use line-shooters with weighted branch lines), when fishing north of 23°N

The social effects would be similar to those described for Alternative SB2A; the primary difference would be that those fishermen that choose to use current measures would not incur the costs and operational difficulties of using blue-dyed bait and strategic offal discard.

4.9.1.24 Alternative SB11B: Use side-setting unless technically infeasible, in which case use an underwater setting chute or a tori line or current measures without blue bait or strategic offal discards (shallow-setting vessels set at night, deep-setting vessels use line-shooters with weighted branch lines), in all areas

The social effects would be similar to those described for Alternative SB2B; the primary differences would be that those swordfish fishermen that choose to use the current mitigation methods would not incur the costs and operational difficulties of using blue-dyed bait and strategic offal discard.

4.9.1.25 Alternative SB12: Voluntarily use night-setting or underwater setting chute or tori line or line-shooter with weighted branch lines south of 23°N

To the extent that fishermen voluntary adopt these additional seabird interaction avoidance methods, benefits would accrue to members of the public concerned about the incidental mortality of seabirds in the Hawaii-based longline fishery. As discussed in Section 4.8.1.25, given the costs and operational difficulties of using an underwater setting chute or tori line, it is unlikely that many vessels would voluntarily adopt these interaction avoidance methods. Vessels that do not already use night-setting or line-shooters with weighted branch lines are unlikely to be willing to adopt these fishing practices or gear solely for the purpose of reducing seabird interactions. Consequently, it is likely that the social effects of this alternative would be similar to those described for Alternative SB1.

4.9.2 Squid Jig Fishery Management Measures

4.9.2.1 Alternative SQA.1: Sub-objective A No Action

Under this alternative the squid fisheries would continue to benefit Hawaii fishing communities as described in Sections 3.7 and 3.8. No specific social groups and cultural factors were identified with the potential to be adversely affected by this alternative. This alternative has no environmental justice implications for minority populations or low-income populations in Hawaii.

4.9.2.2 Alternative SQA.2: Voluntary Monitoring

The social effects would be similar to those described for Alternative SQA.1 (Sub-objective A No Action).

4.9.2.3 Alternative SQA.3 (Sub-objective A Preferred Alternative): Mandatory Monitoring and Management through the Pelagics FMP

The social effects would be similar to those described for Alternative SQA.1 (Sub-objective A No Action).

4.9.2.4 Alternative SQA.4: Mandatory Monitoring and Management through a New Squid FMP

The social effects would be similar to those described for Alternative SQA.1 (Sub-objective A No Action).

4.9.2.5 Alternative SQA.5: Mandatory Monitoring and Management through International Agreement

The social effects would be similar to those described for Alternative SQA.1 (Sub-objective A No Action).

4.9.2.6 Alternative SQB.1: Sub-objective B No Action

The social effects would be similar to those described for Alternative SQA.1 (Sub-objective A No Action).

4.9.2.7 Alternative SQB.2: Cease Issuing HSFCA Permits

As discussed in Section 4.8.15, this alternative would impose a significant economic hardship on the one domestic operation currently engaged in fishing for squid on the high seas in the Pacific Ocean. Without a HSFCA permit the operation would no longer be able to legally participate in the highs seas squid fishery. The discussion in Section 4.8.15 notes that opportunities for the operation to recover its lost harvest and income are likely to be limited, and it is probable that the firm would be forced to sell out. It is uncertain how active the nationwide or international market is for the types of vessels, gear and other investment capital employed by the firm. If the immediate resale market for these assets is small, the vessel owners would experience a significant economic hardship. Unemployed crew members would also suffer from a loss of income; the ability of these individuals to find suitable alternative employment is unknown. Based on the vessel crew sizes presented in Section 3.7, it is estimated that about 54 individuals would be affected. The ethnic composition and income of the vessels' owners and crews are unknown. Consequently, it is uncertain if minority populations or low income populations would be disproportionately affected by this alternative.

4.9.2.8 Alternative SQB.3: Voluntary Monitoring

The social effects would be similar to those described for Alternative SQA.1 (Sub-objective A No Action).

4.9.2.9 Alternative SQB.4 (Sub-objective B Preferred Alternative): Mandatory Monitoring and Management through New Logbooks

The social effects would be similar to those described for Alternative SQA.1 (Sub-objective A No Action) and Alternative SQB.1 (Sub-objective B No Action).

4.9.2.10 Alternative SQB.5: Mandatory Monitoring and Management through FMPs

The social effects would be similar to those described for Alternative SQA.1 (Sub-objective A No Action) and Alternative SQB.1 (Sub-objective B No Action).

4.9.2.11 Alternative SQB.6: Mandatory Monitoring and Management through International Agreement

The social effects would be similar to those described for Alternative SQA.1 (Sub-objective A No Action) and Alternative SQB.1 (Sub-objective B No Action).

4.10 Impacts to Administration and Enforcement

4.10.1 Seabird Interaction Avoidance Methods

None of the seabird interaction avoidance measure alternatives would substantively affect administration of the Pelagics FMP. Neither permitting nor data collection activities would be affected. Allocation of shallow-set certificates would not be altered. There would be no change to levels of observer coverage for shallow (100%) or deep (20%) fishing, or to the duties of the observers. Likewise, enforcement efforts would not require modification. The efficacy of the enforcement efforts however, would change depending on the seabird interaction avoidance method or methods adopted. Table 2.1-1 in Chapter 2 summarizes qualitative rankings of the various interaction avoidance methods for their ease of enforcement. Clearly side-setting, where equipment is permanently welded into place, is easily verified by dockside inspection, and assures compliance. Side-setting is optional or required in Alternatives SB2 and SB5-SB12. It may be possible to verify night-setting with VMS data, and inspection of gear at dockside or by at-sea boarding could verify use of proper branch line weighting, but each of the other methods may be problematic in some way or other. For example, a vessel could have a setting chute, blue dye, or a tori line on board, but verification of proper use can only be done if there is an observer on board or surveillance from an aircraft or cutter during a set. The same applies to use of strategic offal discards. From an enforcement standpoint, those alternatives requiring the use of side-setting (Alternatives SB8 and SB9) are preferred.

4.10.2 Squid Jig Fishery Management Alternatives

4.10.2.1 Alternative SQA.1: Sub-objective A No Action

The No Action Alternative for management of squid fisheries within Council jurisdiction would continue the current situation of no administration or enforcement under the MSA. There would be no impacts to current administrative or enforcement activities.

4.10.2.2 Alternative SQA.2: Voluntary Monitoring

Improvement of voluntary monitoring of the squid fishery would entail some additional administrative efforts. It is expected that fishers would complete and submit a logbook and at least one observer would be deployed in the fleet. Administrative costs and efforts would be expended in designing, distributing, and collecting logbooks, deploying and supporting the observer, and collating and analyzing logbook and observer data. No enforcement costs would be incurred in implementing this voluntary alternative.

4.10.2.3 Alternative SQA.3 (Sub-objective A Preferred Alternative): Mandatory Monitoring and Management through the Pelagics FMP

Adding species of squid to the list of PMUS in the Pelagics FMP would trigger all of the administrative activities under the MSA including collection of data on catch and effort, bycatch and protected species interactions, etc., and inclusion of these data in the Pelagics Annual Report. Submission of the data would become compulsory rather than voluntary, and a mechanism would be available for expeditious regulatory changes to be made if necessary. Fishers would be required to complete and submit a logbook and at least one observer would be deployed in the fleet. Administrative costs and efforts would be expended in designing, distributing, and collecting logbooks, deploying and supporting the observer, and collating and analyzing logbook and observer data. At this time it is not expected that there would be imposed any rules controlling fishery operations, so enforcement activities would be limited to insuring data submittals.

4.10.2.4 Alternative SQA.4: Mandatory Monitoring and Management through a New Squid FMP

This alternative would have the greatest administrative costs of the first set of alternatives. Whereas under Alternative SQA.3 (Sub-objective A Preferred Alternative), the squid fishery efforts would be appended to an existing FMP that has a functional Plan Team and well-established procedures for monitoring the fisheries and producing the annual report, creation of a new FMP would entail a great deal of redundant effort to comply with the requirements of the MSA for FMPs, including establishing a new Plan Team, producing an annual report, etc. A mechanism would be available for expeditious regulatory changes to be made if necessary. In addition, separating the analyses of the squid species from the remainder of the pelagic species would not further the movement towards ecosystem-based fishery management, and at some future time the two FMPs might have to be consolidated, which would entail additional administrative costs. At this time it is not expected that there would be imposed any rules controlling fishery operations, so enforcement activities would be limited to insuring data submittals.

4.10.2.5 Alternative SQA.5: Mandatory Monitoring and Management through International Agreement

Administrative and enforcement efforts and costs associated with this alternative are uncertain, as they would be determined after agreement on a management regime in a future international forum.

4.10.2.6 Alternative SQB.1: Sub-objective B No Action

The No Action Alternative for Sub-objective B would leave the current management regime under the HSFCA unchanged. Administrative costs would continue to be incurred in managing the permit system, but the incremental cost due to squid jigging vessels is quite small. Logbook information would continue to be collected and archived, but not collated, analyzed or distributed. Enforcement would be limited to ensuring vessels are permitted and logbooks are submitted.

4.10.2.7 Alternative SQB.2: Cease Issuing HSFCA Permits

This alternative would result in a phase-out of squid fishing as current permits expire. Ultimately efforts and costs associated with administration and enforcement for the U.S. high seas squid jigging fishery would cease. It is possible however, that the affected vessels would be returned to service in another high seas fishery requiring HSFCA permits, in which case the net impact would be zero.

4.10.2.8 Alternative SQB.3: Voluntary Monitoring

Impacts would be similar to those of Alternative SQA.2.

4.10.2.9 Alternative SQB.4 (Sub-objective B Preferred Alternative): Mandatory Monitoring and Management through New Logbooks

Under this alternative the HSFCA logbooks currently employed would be replaced with new ones designed specifically for squid jigging operations. Data collected via the logbooks would be collated, analyzed and distributed, as appropriate. In addition, the HSFCA permit applications should be modified to specify the applicant's intended fishery and gear. New permit application forms and logbooks should be designed and distributed and data management requirements would increase.

4.10.2.10 Alternative SQB.5: Mandatory Monitoring and Management through New FMPs

The impacts of this alternative would be similar to those of Alternatives SQA.3 (Sub-objective A Preferred Alternative) or SQA.4, depending on whether the Council(s) decided to add squid to an existing FMP or create a new FMP specifically for squid. If more than one Council were involved, additional costs could be incurred in coordination of efforts.

4.10.2.11 Alternative SQB.6: Mandatory Monitoring and Management through International Agreement

Impacts of this alternative would be similar to those of Alternative SQA.5, SQA.1 (Sub-objective A No Action) and SQB.1 (Sub-objective B No Action).

4.11 Cumulative Effects

Analysis of the potential cumulative effects of a proposed action and its alternatives is a requirement of NEPA. Cumulative effects are those combined effects on the quality of the human environment that result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what Federal or non-Federal agency or person undertakes such other actions (40 CFR 1508.7, 1508.25(a), and 1508.25 (c)). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. The concept behind cumulative effects analysis is to capture the total effects of many actions over time that could be missed by evaluating each action individually. At the same time, the CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action on the universe but to focus on those effects that are truly meaningful. To avoid piecemeal assessment of environmental impacts, cumulative effects were included in the 1978 CEQ regulations, which led to the development of the CEQ's cumulative effects handbook (CEQ 1997) and Federal agency guidelines based on that handbook (e.g., EPA 1999).

Cumulative effects would occur when direct and indirect effects of the alternatives considered in this EIS combine with effects of other past, present and reasonably foreseeable future actions to produce a net effect different than the separate effects or the other factors. These net effects can be beneficial or adverse. Principles of cumulative effects analysis identified by the Council on Environmental Quality include the following:

1. Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who (Federal agency, other government agency, or private entity) has taken the actions;
2. Cumulative effects must be analyzed in terms of the specific resource, ecosystem, and human community being affected;
3. It is not practical to analyze the cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful. In addition, there must be a relationship or "nexus" between the direct and indirect effects of the alternatives being evaluated and external effects;
4. Cumulative effects on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries;
5. Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects;
6. Cumulative effects may last for many years beyond the life of the action that caused the effects; and

7. Each affected resource, ecosystem, and human community must be analyzed in terms of its capacity to accommodate additional effects, based on its own time and space parameters.

4.11.1 Analytical Steps

This section assesses the cumulative effects of the alternatives following a series of analytical steps:

1. The potential direct and indirect effects of the alternatives for seabird interaction avoidance in the Hawaii-based longline fleet and alternatives for squid jig fishery management are summarized for each major resource component from analyses in Sections 4.2-4.10. Each alternative may have a different effect on a particular resource.

2. Past, present and reasonably foreseeable factors that are exogenous to fisheries managed under the Pelagics FMP may affect the environmental resources analyzed in Sections 4.2-4.10. The potential effects of these "exogenous" factor(s) on each resource are summarized. The list of exogenous factors and the overall conclusions for each factor remain constant across all alternatives for the seabird action and all alternatives for squid jig fishery management. The potential impacts of fisheries not managed under the Pelagics FMP or HSFCA are considered as exogenous factors.

3. Potential direct and indirect effects of the alternatives (1), combine with the potential effects of exogenous factors (2), as modified by any indirect effects that any of the alternatives may have on exogenous factors, to produce potential cumulative effects.

4.11.2 Cumulative Impacts to the Pelagic Environment

4.11.2.1 Potential Direct and Indirect Effects of Alternatives for Seabird Interaction Avoidance

Only Alternative SB1 (No Action) and the alternatives that offer an option to employ current measures (Alternatives SB2-SB8, SB10 and SB11) potentially impact the pelagic environment and that would be through the discharge of offal and spent bait. Direct impacts would include insignificant, transient and localized reductions of water quality. There would be no detectable indirect effects to the pelagic environment.

4.11.2.2 Potential Direct and Indirect Effects of Alternatives for Squid Jig Fishery Management

With the possible exception of Alternative SQB.2 (cessation of issuing HSFCA permits for squid fishing), none of the alternatives for squid jig fishery management would change current impacts of these vessels to the pelagic environment. Alternative SQB.2 would most likely reduce wastes discharged from squid processing but indirectly increase the discharge of waste from the vessels when rededicated to other uses.

4.11.2.3 Potential Effects of Exogenous Factors

4.11.2.3.1 Non-U.S. Pelagic Longline Fisheries in the North Pacific Ocean

Hawaii-based fisheries represent a small fraction of North Pacific Ocean pelagic longline fishing effort. Impacts to the pelagic environment from all of these fisheries include the discharge of offal, spent bait and unwanted fish. The ecological implications of such discards are not well understood. Dead biological matter discarded in the ocean is a food subsidy and, thus, is presumably recycled. The effects may be considered positively or negatively depending on the values placed on different animals that may benefit from this food supplement and its redistribution. Many species of marine organisms have learned to use fishing activities to their advantage. Seabirds and marine mammals follow fishing vessels to catch prey that are made more vulnerable by longline fishing, steal prey from deployed gear or feed on discards. This type of interaction may have ecological consequences because the fishery may be tilting competitive equilibrium among species. The impact is difficult to quantify because it is usually not clear which species could be harmed in these situations, even when it is clear which species are benefitting.

Selective removal of upper-level predators by non-U.S. pelagic longline fisheries may affect predator-prey relationships throughout the North Pacific Ocean pelagic ecosystem. The fish species targeted and caught incidentally in pelagic longline fisheries are apex predators. Seki and Polovina (2001) used a dynamic ecosystem model to investigate possible impacts of fishing at lower trophic levels in oceanic gyre food webs. They found no evidence that the removal of any single high trophic level species significantly altered the food web. The lack of a keystone species appears to be due to a high degree of diet overlap among the high trophic level species. Fisheries in oceanic gyres alter the food web by reducing the biomass at the top of the food web. When this reduction becomes substantial, the impact may be some increase in biomass at mid-trophic levels (Seki and Polovina 2001).

4.11.2.3.2 Marine Debris in the North Pacific Ocean

Fishing and shipping fleets throughout the North Pacific Ocean add to marine debris through accidental or deliberate discard of shipboard materials. The collective contribution of these fleets to the density of plastic debris in the central North Pacific Ocean is increasing. Analysis of neuston samples from the North Pacific central gyre found a density of small plastic particles far higher than in previous studies that included transects passing through the gyre. This provides evidence that the amount of plastic material in the ocean is increasing over time (Moore et al. 2001), which Day and Shaw (1987) previously suggested based on a review of historical studies. Plastic degrades slowly in the ocean. Some of the larger pieces may accumulate enough fouling organisms to cause them to sink but the smaller pieces are usually free of fouling organisms and remain afloat. The North Pacific Ocean has few islands and the dominant eddy currents serve as a retention mechanism that prevents small plastics from moving toward mainland coasts, where they could be washed ashore (Moore et al. 2001). The long-term ecological impacts of the increasing density of plastic debris are uncertain but likely negative.

4.11.2.4 Potential Cumulative Effects of Alternatives for Seabird Interaction Avoidance

The direct and indirect effects of the alternatives for seabird interaction avoidance would not be expected to add incremental impacts or modify the cumulative effects of exogenous factors.

4.11.2.5 Potential Cumulative Effects of Alternatives for Squid jig Fishery Management

The direct and indirect effects of the alternatives for squid jig fishery management would not be expected to add incremental impacts or modify the cumulative effects of exogenous factors.

4.11.3 Cumulative Effects to Squid

4.11.3.1 Potential Direct and Indirect Effects of Alternatives for Seabird Interaction Avoidance

Only Alternative SB1 (No Action) and the alternatives that offer an option to employ current measures (Alternatives SB2-SB8, SB10 and SB11) potentially impact squid resources indirectly through strategic offal discard, spent bait discard and minimization of lights (that might attract squid) during nighttime operations. No direct effects are anticipated.

4.11.3.2 Potential Direct and Indirect Effects of Alternatives for Squid Jig Fishery Management

None of the alternatives, including SQB.2 (cessation of issuing HSFCA permits for squid fishing), would have any discernible effect on squid stocks.

4.11.3.3 Potential Effects of Exogenous Factors

The only relevant exogenous factor is non-U.S. pelagic longline fisheries in the North Pacific Ocean. U.S. jig fisheries for squid are responsible for an extremely small fraction of the North Pacific Ocean squid harvest. The red flying squid population has recovered from a decade of heavy fishing pressure (1980s) following the cessation of most Asian high-seas drift gill net fisheries in 1992. Stocks are presently healthy although jig fishing pressure by Asian fleets is increasing. Stock-wide fishing pressure is not as great on the purpleback flying squid because it is less marketable than red flying squid, so is not harvested on a large-scale by Asian fleets. No impact on either stock is discernible at current levels of harvesting.

4.11.3.4 Potential Cumulative Effects of Alternatives for Seabird Interaction Avoidance

The direct and indirect effects of the alternatives for seabird interaction avoidance would not be expected to add incremental impacts or modify the cumulative effects of exogenous factors.

4.11.3.5 Potential Cumulative Effects of Alternatives for Squid Jig Fishery Management

The direct and indirect effects of the alternatives for squid jig fishery management would not be expected to add incremental impacts or modify the cumulative effects of exogenous factors.

4.11.4 Cumulative Effects to PMUS and non-PMUS

4.11.4.1 Potential Direct and Indirect Effects of Alternatives for Seabird Interaction Avoidance

None of the alternatives for seabird interaction avoidance would be expected to directly or indirectly affect PMUS or non-PMUS.

4.11.4.2 Potential Direct and Indirect Effects of Alternatives for Squid Jig Fishery Management

None of the alternatives for squid jig fishery management would be expected to directly or indirectly affect PMUS or non-PMUS.

4.11.4.3 Potential Effects of Exogenous Factors

4.11.4.3.1 Non-U.S. Pelagic Fisheries

Hawaii-based fisheries account for a small fraction of the target and incidental fish catch by pelagic longline fisheries operating in the central and western Pacific Ocean. Pelagic longline fisheries are multi-species; i.e., they rely on the harvest of several ecologically-related pelagic fish species for fishing income. Thus, the impacts of longline fishing on fish populations is spread over multiple apex predator species instead of concentrated on one or two target species. With the exception of tuna and billfish species, however, there is limited information on the stock condition of PMUS and non-PMUS that are commonly caught and therefore little basis for assessing resource status.

2002 and 2003 stock assessments for Pacific bigeye tuna indicate that overfishing is occurring but the stock is not overfished. As only 1.5% of Pacific Ocean-wide fishing mortality of bigeye tuna is attributed to Hawaii pelagic fisheries (WPRFMC 2004a), fisheries not managed under the Pelagics FMP have a significant impact.

Based on the reference points in the Pelagics FMP, there is no immediate concern about overfishing of any other stock for which there is adequate information. The contribution of fisheries authorized under the Pelagics FMP to fishing mortality of these species is small compared to other pelagic fisheries, with the exception of swordfish. These data, however, represent the catch prior to the 2001 shallow-set ban. Currently, effort in the Hawaii-based fleet is authorized at half that level.

4.11.4.3.2 Western and Central Pacific Tuna Commission

At its first meeting in December 2004, the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the WCPO resolved that it would respond to the advice of its Scientific Committee and Technical and Compliance Committee and other information by adopting conservation and management measures necessary to address bigeye and other tuna sustainability concerns at its next meeting in December 2005. Such measures may include catch or effort limits, capacity limits for large-scale vessels, and others (Western and Central Pacific Fisheries Commission 2004). If adopted and successfully implemented, such measures would be expected to impact Pacific bigeye and other tuna stocks by reducing fishing mortality over the long term.

4.11.4.4 Potential Cumulative Effects of Alternatives for Seabird Interaction Avoidance

The direct and indirect effects of the alternatives for seabird interaction avoidance would not be expected to add incremental impacts or modify the cumulative effects of exogenous factors.

4.11.4.5 Potential Cumulative Effects of Alternatives for Squid Jig Fishery Management

The direct and indirect effects of the alternatives for squid jig fishery management would not be expected to add incremental impacts or modify the cumulative effects of exogenous factors.

4.11.5 Cumulative Effects to Seabirds

4.11.5.1 Potential Direct and Indirect Effects of Alternatives for Seabird Interaction Avoidance

All of the alternatives for seabird interaction avoidance would have effects on North Pacific albatross populations, directly because of the potential for incidental seabird catch and associated mortality, and indirectly because loss of a breeding bird likely also causes loss of a chick and reduces the breeding population until the surviving bird finds another mate. The projections of annual seabird interactions by alternative in Table 4.5-3 underestimate the effects on populations (because they do not account for seabird drop-offs after capture or post-release mortality of birds released alive) but they are useful for comparing direct and indirect effects of the seabird interaction avoidance alternatives.

4.11.5.2 Potential Direct and Indirect Effects of Alternatives for Squid Jig Fishery Management

None of the alternatives for squid jig fishery management would be expected to directly affect North Pacific seabird resources. Indirectly, alternatives that provide for observer coverage (voluntarily under Alternatives SQA.2 and SQB.3; as required by NMFS under Alternatives SQA.3 (Sub-objective A Preferred Alternative) and SQB.4 (Sub-objective B Preferred Alternative)) would improve the sparse information base that is presently available concerning interactions between seabirds and squid jig fisheries.

4.11.5.3 Potential Effects of Exogenous Factors

Albatross populations in the North Pacific Ocean live in an environment that has been substantially affected by anthropogenic factors. Major impacts in the past that are part of the existing baseline include the intensive collection of short-tail albatross feathers in Japan during the early 20th century; the Battle of Midway during World War II and subsequent U.S. military use of Midway Island; and Asian high-seas drift net fisheries during the 1980s.

4.11.5.3.1 Degradation of Albatross Nesting Habitats

Overall, negative human impacts to albatross nesting habitats are abating in Japan and the Northwestern Hawaiian Islands. Currently active breeding colonies for the short-tailed albatross in Japan and the major nesting colonies of the black-footed and Laysan albatrosses in the Northwestern Hawaiian Islands are part of government refuges managed for the conservation of wildlife. Thus, human access and associated disturbance are limited.

Due to management changes at Midway Atoll National Wildlife Refuge, air traffic and visitor use are considerably reduced, diminishing the threats to seabirds from air strikes and ecotourism. Cruise boats occasionally land visitors at Midway and the airfield is maintained as an emergency landing site, so there is still potential for visitor-related and aircraft-related impacts.

Exposure to lead and PCBs remain hazards to seabirds at the decommissioned military base in the Midway Island National Wildlife Refuge and the decommissioned LORAN station at Tern Island, French Frigate Shoals. Despite previous lead remediation (1994-1997) on Midway, Laysan albatross chicks continue to be exposed to substantially elevated levels of lead from the ingestion of lead-based paint from deteriorating buildings. This represents a serious health threat based on several reports of increased morbidity and mortality of Laysan albatross chicks nesting in the vicinity of buildings. The death of Laysan albatross chicks in a species of low productivity impedes efforts to conserve this species (Finkelstein et al. 2003). The U.S. Fish and Wildlife Service (USFWS) is attempting to assess and mitigate the lead paint problem but, under the terms of the turnover and the provisions of the Comprehensive Environmental Response, Compensation and Liability Act, it is the responsibility of the U.S. Navy to abate and remediate the lead-based paint remaining on Navy buildings when authority over Midway was ceded to the USFWS in 1997. The future potential of Midway Atoll NWR to serve as a nesting colony for short-tailed albatross, through either natural colonization or propagation efforts, remains unknown (USFWS 2000).

4.11.5.3.2 Continued Exposure to Environmental Contaminants, Especially PCBs

Black-footed and Laysan albatrosses from the North Pacific Ocean contain higher levels of organochlorine residues (polychlorinated dibenzo-p-dioxins, PCDDS; polycholorinated dibenzofurans, PCDFs; and polychlorinated biphenyls, coplanar PCBs) than albatrosses in the South Pacific Ocean. Residue levels in albatrosses from the remote North Pacific Ocean far from point sources of pollution are comparable to or higher than those in terrestrial and coastal birds from contaminated areas in developed nations. The long lives of albatrosses and ingestion of plastic resin pellets that account for a high percentage of marine debris in some areas of the ocean are plausible explanations for accumulation of these persistent contaminants in albatrosses (Tanabe et al. 2004). Over the long term, high levels of PCBs may negatively affect the health of North Pacific Ocean albatross populations.

4.11.5.3.3 Continued Exposure to Concentrations of Small Plastic Debris in the North Pacific Ocean

Studies in the last 25 years have documented the prevalence of plastic in the diets of many seabird species in the North Pacific Ocean. Plastics may be consumed directly because particles resemble prey items or, indirectly, by eating prey attached to plastics or with plastics in their gut. In turn, adult seabirds may pass plastics on to chicks by regurgitation.

Studies of the distribution and abundance of small plastic particles in the North Pacific Ocean report that pelagic plastic is most abundant in the central subtropical and western North Pacific Ocean. User plastics, small, weathered remnants of larger manufactured items that are discarded or lost at sea by fishing vessels and shipping traffic, are the predominant type of plastic ingested by seabirds in the central North Pacific Ocean (Day and Shaw 1987). Currents and convergences of the region concentrate marine debris at levels that appear higher than for any other oceanic regions of the world and leading to some of the highest global incidence of plastic ingestion in central North Pacific Ocean seabirds (Robards et al. 1997).

Available evidence suggests that plastics are damaging to seabirds when they are consumed in sufficient quantities to obstruct the passage of food or cause stomach ulcers, through bioaccumulation of polychlorinated biphenyls (PCBs), toxic effects of hydrocarbons, diminished feeding stimulus, reduced fat deposition, lowered steroid hormone levels and delayed reproduction. However, acute effects of plastic ingestion are rarely observed and a search for correlations between plastic load and health indices for wild populations of seabirds has been generally unsuccessful in producing any more than indirect evidence of chronic health effects. Spear et al. (1995) is the only investigation to show a statistically significant negative correlation between plastic loads and seabird body weight.

4.11.5.3.4 Incidental Seabird Mortality in Longline Fisheries not Regulated Under the Pelagics FMP

Black-footed and Laysan albatross, and occasionally short-tailed albatross, are incidentally captured in Alaskan demersal longline fisheries. NMFS published a final rule on January 13, 2004, to revise regulations requiring seabird avoidance measures in hook-and-line fisheries of the Bering Sea and Aleutian Islands management area and Gulf of Alaska, and in the Pacific Ocean halibut fishery in U.S. Convention waters off Alaska. This action is intended to improve the current requirements and further mitigate interactions with the short-tailed albatross and other species of seabirds in hook-and-line fisheries in and off Alaska (69 FR 1930, Jan. 13, 2004).

Reducing incidental seabird catch in U.S. fisheries alone will not significantly reduce longline fisheries as a source of mortality to North Pacific albatross populations. The Hawaii longline fleet is a small component of total pelagic longline fishing effort in the North Pacific Ocean. Pelagic longline fishing effort by Asian fleets continues to expand in the North Pacific Ocean. Some of these fleets are known to set gear using “shallow ” swordfish and “mixed” tuna/billfish methods (Bartram and Kaneko 2004) that have levels of interactions with seabirds 40-70 times higher than deep-set methods (Cousins et al. 2000). For example, since 1997, fishing by the Taiwan freezer longline fleet has been increasing in waters north of the Hawaiian Islands. In 2000, effort by this fleet between 25° and 40°N and between 180° and 140°W exceeded 6 million hooks (Wang et al. 2002: Figure 1).

The National Research Institute of Far Seas Fisheries of Japan’s Fisheries Research Agency has initiated scientific activities to develop, evaluate and improve various kinds of seabird interaction avoidance methods. Of the many measures tested in Japan, blue-dyed bait has proven to be the most effective in reducing visibility of baits and in preventing bait-taking by seabirds. Japan’s National Plan of Action for Seabirds requires longline vessels operating north of 20°N in the North Pacific Ocean to adopt at least one interaction avoidance measure to avoid interactions with seabirds. Longline vessels that operate within 20 miles of Torishima island, the major breeding island of the short-tailed albatross, are required to adopt two or more seabird interaction avoidance measures (Kiyota et al. 2003).

The U.S. is implementing a National Plan of Action to reduce the incidental catch of seabirds in U.S. fisheries. Other than Japan and the U.S., however, few national governments are engaged in policy-making, research, monitoring and enforcement to reduce incidental seabird catches by fishing fleets under their flags. Negative effects on seabird populations remain high because the majority of North Pacific longline fishing continues without the use of seabird interaction avoidance measures.

4.11.5.3.5 Transfer of Seabird Interaction Avoidance Measures

Incidental seabird catch could be substantially reduced in North Pacific pelagic longline fisheries through adoption and enforcement of national regulations to control seabird bycatch and practical demonstrations of seabird interaction avoidance measures effectiveness (Gilman and Freifeld 2003). There are two levels at which practical information about seabird avoidance measures can be transferred. The first level is to disseminate written material and videotapes, translated into appropriate languages for the target longline fishing nations, at international trade shows and other meetings (particularly International Fishers' Fora), where there is exchange among fishermen, scientists and resource managers. The second level is industry-to-industry transfer of seabird interaction avoidance technology under arrangements between fishing organizations in longline fishing nations. Both levels of activities can occur with or without formal government-to-government agreements. There is precedent for such a program in the cooperative efforts of the Hawaii Longline Association, the Western Pacific Fishery Management Council, the National Marine Fisheries Service and Blue Ocean Institute to conduct research and commercial demonstration on a Hawaii longline vessel of three seabird interaction avoidance methods (Gilman et al. 2003). Broad multi-national longline industry compliance to reduce incidental seabird catch would have positive impacts on the seabird resource.

<u>4.11.5.4 Potential Cumulative Effects of Alternatives for Seabird Interaction Avoidance</u>

Annual incidental interactions of North Pacific albatrosses by Asian longline fisheries may number in the thousands (Cousins et al. 2000). Therefore, seabird interaction avoidance alternatives for which low numbers of annual seabird interactions are projected have minor effects when compared to the estimated annual incidental catch of thousands of albatrosses by Asian longline fisheries operating in the North Pacific Ocean.

Any of the seabird interaction avoidance alternatives considered here would offer the opportunity for appraisal of the efficacy of the respective measures employed in actual fishing operations. NMFS observer coverage of at least 20 percent of deep-set Hawaii tuna longline trips and 100% of shallow-set Hawaii swordfish longline trips would allow collection of detailed information about the effectiveness of these measures. Analysis of this data would demonstrate the relative effectiveness of the various measures and greatly facilitate transfer of the most cost-effective measures to multi-national longline fleets. Thus, all of the seabird interaction avoidance alternatives have the potential to indirectly modify the cumulative effects associated with an exogenous factor (transfer of seabird interaction avoidance measures).

4.11.5.5 Potential Cumulative Effects of Alternatives for Squid Jig Fishery Management

The direct and indirect effects of the alternatives for squid jig fishery management would not be expected to add incremental impacts or modify the cumulative effects of exogenous factors.

4.11.6 Cumulative Effects to Sea Turtles

4.11.6.1 Potential Direct and Indirect Effects of Alternatives for Seabird Interaction Avoidance

None of the alternatives for seabird interaction avoidance would change current direct effects on sea turtle resources. Current seabird interaction avoidance measures (Alternative SB1, No Action) and those alternatives that contain current measures as an option (Alternatives SB2-SB8, SB10 and SB11) may have minor indirect effects on sea turtles through attraction to offal or reduced attraction by minimization of nighttime lighting on vessels.

4.11.6.2 Potential Direct and Indirect Effects of Alternatives for Squid Jig Fishery Management

It is unlikely that any of the alternatives for squid jig fishery management would have direct or indirect impacts on sea turtles. Alternative SQB.2 would phase out the current small U.S. pelagic squid fleet and the indirect effect of this alternative on sea turtles would depend on the uses to which the displaced vessels are put. However, even if all four current squid vessels were to enter fisheries where sea turtles are incidentally hooked, their impact would be insignificant in the context of the total effort in international fisheries in the Pacific Ocean. Indirectly, alternatives that provide for observer coverage (voluntarily under Alternatives SQA.2 and SQB.3; as required by NMFS under Alternatives SQA.3 (Sub-objective A Preferred Alternative) and SQB.4 (Sub-objective B Preferred Alternative)) would improve the sparse information base that is presently available concerning interactions between sea turtles and squid jig fisheries.

4.11.6.3 Potential Effects of Exogenous Factors

Four exogenous factors impact sea turtle resources:

1. Direct take of eggs and female adult turtles at nesting sites;
2. Degradation of nesting habitat;
3. Pollution of marine habitat (including marine debris); and
4. Incidental capture and mortality in fisheries not managed under the FMP for Pelagic Fisheries of the Western Pacific Region.

Comprehensive analysis of these factors is provided in the Pelagics SEIS (WPRFMC 2004b). That analysis is included here by reference and is not repeated in this EIS. Despite active efforts to mitigate the effects of all four factors, the prognosis for the future survival and recovery of some sea turtle populations remains negative. A multi-national, holistic (covering all turtle life phases) framework for sea turtle conservation is considered essential (Bellagio Conference Nov. 2003).

The impact of the fourth factor is changing because of the demonstration and transfer of sea turtle incidental catch reducing measures. Incidental sea turtle catch continues unabated in Asian pelagic longline fisheries operating in the North Pacific Ocean. For example, at a bycatch working group meeting of the IATTC, held in Kobe, Japan on January 14-16, 2004, a member of the Japanese delegation stated that, based on preliminary data from 2000, the Japanese tuna longline fishery was estimated to take approximately 6,000 sea turtles, with a 50 percent mortality rate. Little information on species composition was given, however, of the estimated 160 leatherbacks taken, 25 were dead (K. Hanafusa, Fisheries Agency of Japan, pers. comm., Jan. 2004 cited in NMFS undated: 141). As the average turtle "take" rate is approximately 10 times higher in shallow-set longline sets than in deep longline sets, incidental sea turtle catches are likely much higher in Taiwanese and Chinese pelagic shallow-set longline fisheries than in the Japanese deep-set fishery.

International codes of conduct, regional memoranda of understanding and voluntary plans of action to reduce marine turtle bycatch on the high seas must to be supported by the active engagement of longline industries at the fisherman's level (Simonds 2003). In practical terms, this means verifying the effectiveness of specific longline gear modifications or tactics in reducing turtle bycatch and transferring this technology through fishing associations and industry working relationships (Simonds 2003). The series of International Fishers' Fora sponsored by the Council and its partners to address longline bycatch problems in the Pacific Ocean recognize that most of the solutions have originated with fishermen (WPRFMC 2003a). Although the Hawaii longline fishery and its impacts on marine turtles are insignificant in comparison with the overall international longline fishing effort in the Pacific Ocean, Hawaii's model shallow-set swordfish fishery could play a pivotal role in demonstrating and transferring methods of effectively reducing sea turtle bycatch to multi-national longline fisheries (Simonds 2003). The impact would be highly positive.

4.11.6.4 Potential Cumulative Effects of Alternatives for Seabird Interaction Avoidance

The direct and indirect effects of the alternatives for seabird interaction avoidance would not be expected to add incremental impacts or modify the cumulative effects of exogenous factors.

4.11.6.5 Potential Cumulative Effects of Alternatives for Squid Jig Fishery Management

The direct and indirect effects of the alternatives for squid jig fishery management would not be expected to add incremental impacts or modify the cumulative effects of exogenous factors.

4.11.7 Cumulative Effects to Marine Mammals

4.11.7.1 Potential Direct and Indirect Effects of Seabird Interaction Avoidance Alternatives

None of the alternatives for seabird interaction avoidance would change current direct effects on marine mammals. To the extent that any of the alternatives would facilitate bait retention on hooks, either through reduced seabird depredation or reduced mechanical loss, interactions with marine mammals could increase somewhat. No indirect effects are anticipated.

4.11.7.2 Potential Direct and Indirect Effects of Squid Jig Fishery Management Alternatives

None of the alternatives for squid jig fishery management would change current direct effects on marine mammals. Indirectly, alternatives that provide for observer coverage (voluntarily under Alternatives SQA.2 and SQB.3; as required by NMFS under Alternatives SQA.3 (Sub-objective A Preferred Alternative) and SQB.4 (Sub-objective B Preferred Alternative)) would improve the sparse information base that is presently available concerning interactions between marine mammals and squid jig fisheries.

4.11.7.3 Potential Effects of Exogenous Factors

Comprehensive analysis of exogenous factors contributing to cumulative effects to marine mammals is provided in the Pelagics SEIS (NMFS 2001a). That analysis is incorporated by reference and is not repeated in this EIS. However, the impacts of two factors previously evaluated may be increasing.

4.11.7.3.1 Ship Traffic and Anthropogenic Noise

There is growing concern that increasing levels of anthropogenic noise in the ocean may be detrimental to whales, particularly those species that use low frequency sound to communicate, such as baleen whales (Forney et al. 2000). Several investigators have suggested that noise may have caused humpback whales in Hawaii to avoid or leave feeding or nursery areas (Dean et al. 1985), whereas others have suggested that humpback whales may become habituated to vessel traffic and its associated noise. In Hawaii, regulations prohibit boats from approaching within 91 m of adult whales and with 274 m in areas protected for mothers with a calf. In Alaska, the number of cruise ships entering Glacier Bay has been limited to reduce possible disturbance to whales. In the coastal waters of Washington state, increased noise from tourist boat traffic may be drowning out killer whales' ability to hear one another's calls (Foote et al. 2004).

4.11.7.3.2 Interactions with Pelagic Fisheries Not Managed under the Pelagics FMP

Small-toothed whales are known to sometimes take hooked fish and bait from longline, a behavior known as "depredation." As longline fishing effort expands in the Pacific Ocean, reports of these interactions have increased in recent years. It is unclear whether this is due to inaccurate reporting of whale damage to fish as shark damage or a behavior that has been learned by a number of cetacean species. The SPC has estimated that the impact of depredation by whales on hooked fish in the SPC monitoring area is relatively minor (0.8 percent of observed hooks) compared to the impact of sharks (Anon. 2003).

4.11.6.4 Potential Cumulative Effects of Alternatives for Seabird Interaction Avoidance

The direct and indirect effects of the alternatives for seabird interaction avoidance would not be expected to add incremental impacts or modify the cumulative effects of exogenous factors.

4.11.6.5 Potential Cumulative Effects of Alternatives for Squid Jig Fishery Management

The direct and indirect effects of the alternatives for squid jig fishery management would not be expected to add incremental impacts or modify the cumulative effects of exogenous factors.

4.11.8 Cumulative Effects to Economies

4.11.8.1 Potential Direct and Indirect Effects of Alternatives for Seabird Interaction Avoidance

All of the alternatives for seabird interaction avoidance have associated direct costs for installation and operation of seabird interaction avoidance measures. Section 4.8 predicts the annual cost of each alternative for the entire Hawaii longline fishery. The least costly alternatives would be SB9A, SB9B and SB10A, all under $11,000 per year for the entire fleet.

Most alternatives may also indirectly cause some reduction in fishing efficiency. The exceptions are Alternative SB9A and Alternative SB9B which require side-setting, a method that has been demonstrated not to reduce fishing efficiency.

4.11.8.2 Potential Direct and Indirect Effects of Alternatives for Squid Jig FisheryManagement

Alternative SQB.2 would impose a significant economic hardship on the one domestic operation currently engaged in fishing for squid on the high seas. Without a HSFCA permit, the operation would no longer be able to legally participate in the fishery. Owners and crews of displaced vessels would suffer a loss of income and the boats might have to be sold for a loss. The other alternatives would have only minor economic effects.

4.11.8.3 Potential Effects of Exogenous Factors

4.11.8.3.1 Regulatory Regimes External to the Pelagics FMP

At least two regulatory regimes external to the Pelagics FMP have the potential for significant impacts to economies. The first is a NMFS regulation implementing measures to prevent overfishing of ETPO tuna stocks, consistent with recommendations by the IATTC. The rule limited 2004 bigeye tuna catches by U.S. longliners, including Hawaii-based vessels, in the IATTC convention area to 150 mt. This quota was reached in December 2004. Annual bigeye tuna catches by the Hawaii longline fleet have ranged from 52 mt to 171 mt (average = 162 mt) per year, or 78 percent of the total U.S. longline catch during the 1999-2003 period.

The second is the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the WCPO, which at its inaugural meeting in December 2004 resolved that it would respond to the advice of its Scientific Committee and Technical and Compliance Committee and other information by adopting conservation and management measures necessary to address bigeye and other tuna sustainability concerns. Preliminary action is scheduled for the second annual meeting (December 2005). Such measures may include catch or effort limits, capacity limits for large-scale vessels, and others (Western and Central Pacific Fisheries Commission 2004). If Hawaii longline fisheries are included in any future management regime, adverse economic effects can be expected.

4.11.8.3.2 Influence of Environmental Issues on Seafood Marketing and Demand

Environmental issues associated with fish and fishing can influence consumer preferences and demand for seafood. Current marketing and pricing mechanisms do not incorporate the environmental impact costs associated with purchasing fish from different sources. Seafood consumers, therefore, are often unaware of, or indifferent to, the negative or positive environmental consequences they may be endorsing when buying fish from different fleets (Sproul 1998).

During the 1990s, the World Trade Organization (WTO) rejected unilateral efforts by the U.S. to promote conservation of protected marine species through trade sanctions against other governments. Under WTO rules, countries may restrict imports if they fail to meet domestic standards and regulations relating to the physical characteristics of the product, but the power to restrict imports based on standards pertaining to production processes and methods is contested. Environmental impacts are concerned with non-product related criteria, particularly those associated with harvesting methods, sustainability of resources, levels of bycatch and compliance with management (Deere 1999). The key to future international marine conservation through trade will be a multilateral framework rather than a unilateral approach (Joyner and Tyler 2000).

U.S. consumer buying power could be an important factor in shifting demand for particular species or sources of seafood. A poll conducted by the American Association for the Advancement of Science (AAAS 2003) found that 60 percent were willing to eat less of certain fish if it would help to protect natural resources. The importance of product differentiation in some fisheries through labels, such as “dolphin-safe” labeling of canned tuna or “turtle-safe” labeling of shrimp, is an indication of the economic effect these environmental concerns can have. The market impacts of eco-labeling of seafood are discussed by Roheim (2003).

Several organizations have issued guides to encourage seafood consumers in the U.S. to make environmentally-friendly choices of marine species and product sources (http://www.consciouschoice.com/food/consumersseafoodguide1401.html). The criteria considered in preparing such guides are sound (sustainable stocks, levels of bycatch, protected species and habitat impacts), but ultimately all of these guidance systems involve an advisory body that makes qualitative decisions about marine species and product sources. Simple messages, such as buying “dolphin-safe” canned tuna, have proven easier to communicate to consumers than more general objectives, such as promoting “sustainable fisheries.”

Since late 2004, seafood that is retailed in the U.S. is required to have a country of origin label. To bear the U.S. country of origin label, wild fish and shellfish must be caught in U.S. waters or by a U.S.-flagged vessel and processed in the U.S. or aboard a U.S.-flagged vessel (SEAFOOD.COM NEWS, Feb. 4, 2004). This new rule may aid U.S. consumers in identifying products from countries whose fish exports are associated with undesirable environmental impacts.

The “Give Swordfish a Break” media campaign of 1998 (funded by the Pew Charitable Trusts and the Natural Resources Defense Council) is a good example of a specific impact on pelagic fish marketing. The boycott (which ended after two and one-half years) aimed to persuade chefs and consumers to avoid buying North Atlantic swordfish because of reports of a declining population. A specific campaign could be organized to educate consumers about which fishing fleets are employing incidental seabird interaction avoidance measures and which are not. Such information could have a positive impact in guiding purchasing toward more "seabird friendly" pelagic fishery product sources.

4.11.8.3.3 Influence of Health Issues on Seafood Marketing and Demand

Seafood consumers in the U.S. are exposed to two seemingly conflicting arguments about the health effects of eating tuna, swordfish and other pelagic species. The American Heart Association's dietary guidelines for reducing the risk of cardiovascular disease recommend an increase in the consumption of foods rich in omega-3 fatty acids, such as tuna. The guidelines recommend that the general population eat fish twice a week and reference numerous studies showing cardiovascular health benefits (Krauss et al. 2000). A diet that includes fatty fish has also been shown to have specific health benefits for pregnant mothers and their babies.

On the other hand, the U.S. regulates methylmercury in seafood through the Food and Drug Administration (FDA) "action level" of 1.0 part per million (ppm), above which fish products may be removed from the market. Brooks (2004) provides data on methylmercury concentrations in species of pelagic fish commonly landed in Hawaii. Swordfish is the species most likely to exceed 1.0 ppm methylmercury concentration in edible muscle. Japan has a stricter methylmercury limit (0.5 ppm) for most fish species than the U.S. FDA, but tuna and other pelagic top predator species are exempted from the Japanese regulation because of their naturally high background levels of methylmercury. Methylmercury interacts with micronutrients in fish tissue that may make methylmercury less bioavailable and thereby give some protection to marine life, as well as human consumers (Clarkson and Strain 2003). U.S. government agencies have issued advisories warning women of child-bearing age to limit intake of some species of long-lived pelagic fish because fetuses and infants are more sensitive than adults to methylmercury (FDA and EPA 2004). The scientific facts about the potential danger of methylmercury in seafood are subject to wide interpretation, however. Table 4.11-1 shows how greatly the recommended safe daily intake of methylmercury differs from agency to agency.

Table 4.11-1 Comparison of Agency Guidelines for Methylmercury Intake

Agency	Recommended Safe Daily Intake of Methylmercury	Population Targeted for Protection	Study/Method from Which Recommendation Derived	Source of Methyl-mercury in Studied Population	Findings/ Recommendation	Questions About Findings/ Recommendation
FDA[1]	0.47 micrograms per kg of body weight per day	General public	Dosage (methylmercury concentration x consumption by species)	Marine and freshwater fish	Limit consumption of a few species with highest methylmercury levels	May not adequately protect pregnant women and their babies

Agency	Recommended Safe Daily Intake of Methylmercury	Populatio n Targeted for Protection	Study/Method from Which Recommendation Derived	Source of Methyl-mercury in Studied Population	Findings/ Recommendation	Questions About Findings/ Recommendation
ATSDR[2]	0.3 micrograms per kg of body weight per day	Women of child-bearing age, pregnant women and their babies	9-year Seychelle Islands Child Development Study (children pre-natally exposed through mothers' consumption of fish with 12 meals per week).[5]	Marine fish, including tuna, other pelagic spp. (No whales, sharks)	Testing (with high interscore reliability among different examiners[6]) showed no detectable health risk to children resulting from their mothers' ocean fish consumption during pregnancy.	Uncertainty factor applied to account for different findings of Faroe Islands study.
WHO[3]	0.23 micrograms per kg of body weight per day	Women of child-bearing age, pregnant women and their babies	9-year Seychelle Islands Child Development Study (children pre-natally exposed through mothers' consumption of fish with 12 meals per week).[5]	Marine fish, including tuna, other pelagic spp. (No whales, sharks)	Testing (with high interscore reliability among different examiners[6]) showed no detectable health risk to children resulting from their mothers' ocean fish consumption during pregnancy.	Uncertainty factor applied to account for different findings of Faroe Islands study.
EPA[4]	0.1 micrograms per kg of body weight per day	Women of child-bearing age, pregnant women and their babies	Faroe Islands study of 7-year olds pre-natally exposed through their mothers' consumption of pilot whales containing higher methylmercury levels than fish.[7]	Pilot whales	Statistical correlation between umbilical cord blood mercury at birth and subtle changes in neurological development based on testing of physically normal 7 year olds (Poor interscore reliability among different examiners[8]).	Source of methylmercury (whales) also high in PCBs and cadmium, also known to be positively correlated with learning disabilities in children. Whales are not fish.

[1] U.S. Food and Drug Administration.(Center for Food Safety and Applied Nutrition. Food advisory committee – methylmercury. Minutes and Transcript of July 23, 2002, meeting at Sheraton College Park Hotel, Beltsville, MD. www.fda.gov/OHRMS/DOCKETS/ac/02/transcripts/3872t1.htm.).

[2] Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Department of Health and Human Services. January 2004. Minimal risk levels for hazardous substances. U.S. Department of Health and Human Services. Atlanta, GA.

[3] World Health Organization (WHO). Joint FAO/WHO Expert Committee on Food Additives. 2003. Summary and conclusions of 61th meeting. June 10-19, 2003. Rome.

[4]Environmental Protection Agency (EPA). (Center for Food Safety and Applied Nutrition. Food advisory committee – methylmercury. Minutes and Transcript of July 23, 2002, meeting at Sheraton College Park Hotel, Beltsville, MD. www.fda.gov/OHRMS/DOCKETS/ac/02/transcripts/3872t1.htm.). Also, National Research Council. 2000. Toxicological effects of methylmercury. National Academy Press. Washington, D.C. EPA derived its guideline by dividing the most sensitive

observed effect from the Faroe Islands study by an uncertainty factor of 10, thereby establishing a wide margin of safety. Thus, the guideline is not the borderline between safety and potential harm.

[5] Myers, G.J., P.W. Davidson, C. Cox et al. 2003. Prenatal methylmercury exposure from ocean fish consumption: 9-year evaluations in the Seychelles child development study. Lancet 2003; 361: 1686-1692.

[6]Center for Food Safety and Applied Nutrition. Food advisory committee – methylmercury. Minutes and Transcript of July 23, 2002, meeting at Sheraton College Park Hotel, Beltsville, MD. www.fda.gov/OHRMS/DOCKETS/ac/02/transcripts/3872t1.htm.).

[7]Steuerwald, U., P. Weihe, P.J. Jorgensen, et al. 2000. Maternal seafood diet, methylmercury exposure and neonatal neurologic function. Journal of Pediatrics., 136: 599-605.

Consumers are being urged to consider the potential hazard of methylmercury in several contexts: 1) the food matrix of their diets (eating marine fish versus freshwater fish versus sharks versus whales); 2) dose rate in their diets (methylmercury concentration in particular aquatic species times consumption of those species); and 3) the potential loss of health benefits in shifting to non-fish dietary items.

The impact of U.S. government advisories on demand for pelagic fishery products is uncertain. Findings of some surveys and focus groups (Davidson 2004, Oken et al. 2003) suggest that the U.S. general population and pregnant women may heed government warnings to limit consumption of specific marine species and products, including swordfish and canned albacore tuna, because of methylmercury. Other reports suggest that these advisories are not widely known or followed among U.S. seafood consumers (Center for Food Safety and Applied Nutrition. Food advisory committee – methylmercury. Minutes and Transcript of July 23, 2002, meeting at Sheraton College Park Hotel, Beltsville, MD. www.fda.gov/OHRMS/DOCKETS/ac/02/transcripts/3872t1.htm.).

4.11.8.4 Potential Cumulative Effects of Alternatives for Seabird Interaction Avoidance

The potential cumulative effects of the alternatives for seabird interaction avoidance are: 1) in proportion to the direct and indirect costs of installing and operating the combinations of measures required under each alternative; combined with 2) a possible reduction in the effects of an exogenous factor (influence of environmental issues on seafood marketing and demand) under all alternatives except possibly Alternative SB12, as explained below.

Most of the seabird action alternatives would require some combination of seabird interaction avoidance measures, although they would be practiced by vessels voluntarily under Alternative SB12. These measures have been demonstrated in fishing experiments north of Hawaii to markedly reduce the incidental longline catch of albatrosses. NMFS observer coverage of at least 20 percent of deep-set Hawaii tuna longline trips and 100% of shallow-set Hawaii swordfish longline trips would allow collection of detailed information about the effectiveness of these measures as they are applied in commercial fishing. Analysis of this data is expected to validate that the incidental catch of albatrosses in the Hawaii longline fishery has been reduced dramatically compared to levels of seabird interaction recorded by observers in 1994-1999. When this information is incorporated in consumer guides encouraging purchasing from “seabird friendly” product sources, the Hawaii longline fishery would be ranked as a good choice, thus increasing consumer demand. However, the effects of methylmercury advisories could offset some of this effect.

4.11.8.5 Potential Cumulative Effects of Alternatives for Squid Jig Fishery Management

The cumulative effects of Alternative SQB.2 would reflect its significant direct effects on the one domestic operation currently engaged in fishing for squid on the high seas. Without a HSFCA permit, the operation would no longer be able to legally participate in the fishery. Owners and crews of displaced vessels would suffer a loss of income and the boats might have to be sold for a loss. None of the other alternatives for squid jig fishery management would have cumulative effects any greater than minor economic direct/indirect effects previously described.

4.11.9 Cumulative Effects to Social and Cultural Resources

4.11.9.1 Potential Direct and Indirect Effects of Alternatives for Seabird Interaction Avoidance

One group that may be negatively affected by Alternative SB1 (No Action) and Alternative SB12 (voluntary measures south of 23°N latitude) are members of the public who are concerned about protected species issues and especially protection of seabirds. In recent years, seabird mortality in longline fisheries worldwide has been the subject of considerable concern to various environmental advocacy groups. None of the other alternatives for seabird interaction avoidance are likely to have direct effects or indirect effects to social and cultural resources.

4.11.9.2 Potential Direct and Indirect Effects of Alternatives for Squid Jig Fishery Management

Alternative SQB.2 would impose a significant hardship on the one domestic operation currently engaged in squid jigging. Without a HSFCA permit, this operation would no longer be able to legally participate in the high seas squid fishery. Approximately 54 crew members would have to find alternative employment. None of the other alternatives for squid jig fishery management would be expected to have direct or indirect effects to social and cultural resources.

4.11.9.3 Potential Effects of Exogenous Factors

4.11.9.3.1 Employment Options

Crews on the four U.S. squid jig vessels presently operating on the high seas are not based in Hawaii. Their greater mobility and large-vessel experience may afford them a wider range of options if displaced from the squid jig fishery.

4.11.9.3.2 Incidental Mortality of Seabirds in Fisheries Not Managed Under the Pelagics FMP

The alternatives for seabird interaction avoidance would not significantly reduce incidental seabird catch in North Pacific longline fisheries overall because much of the fishing effort is by Taiwanese and Chinese fleets that do not use seabird interaction avoidance measures, in contrast to Japan (and U.S.) longline fisheries.

4.11.9.4 Potential Cumulative Effects of Alternatives for Seabird Interaction Avoidance

Until incidental seabird catch and associated mortality are substantially reduced in non-U.S. longline fisheries operating in the North Pacific Ocean, public concerns about this issue will continue. Thus, none of the alternatives for seabird interaction avoidance would have direct/indirect effects that add incremental impacts or modify cumulative effects.

4.11.9.5 Potential Cumulative Effects of Alternatives for Squid Jig Fishery Management

The likely loss of 54 crew positions under Alternative SQB.2 would eliminate a small sector of U.S. commercial fisheries in the North Pacific Ocean and could even have a small discernible effect when considered in the context of the cumulative number of U.S. fishermen working in North Pacific pelagic fisheries. None of the other alternatives for squid jig fishery management would be expected to add incremental impacts or modify cumulative effects.

4.11.10 Cumulative Effects to Administration and Enforcement

4.11.10.1 Potential Direct and Indirect Effects of Alternatives for Seabird Interaction Avoidance

None of the alternatives for seabird interaction avoidance would substantially affect administration and enforcement of the Pelagics FMP directly or indirectly.

4.11.10.2 Potential Direct and Indirect Effects of Alternatives for Squid Jig Fishery Management

Alternative SQB.2 would eliminate administrative costs but maintain enforcement costs at current levels as HSFCA permits are phased out for U.S. high seas squid fisheries. Alternative SQA.1 (Sub-objective A No Action) and Alternative SQB.1 (Sub-objective B No Action) would continue current direct and indirect effects on administration and enforcement. Alternative SQA.2, Alternative SQB.3, Alternative SQB.4 (Sub-objective B Preferred Alternative) and Alternative SQB.5 would entail some additional administrative, although not enforcement efforts. Alternative SQA.3 (Sub-objective A Preferred Alternative) would trigger all of the administrative activities associated with managing PMUS under the Pelagics FMP but enforcement would remain at current levels because no new rules would be imposed. Alternative SQA.4 would have the greatest administrative costs of the "A" series alternatives because of the activities associated with a new FMP, but enforcement would remain at current levels because no new rules would be imposed. Direct and indirect effects to administration and enforcement under Alternative SQA.5 and Alternative SQB.6 are uncertain because they would be determined after agreement on a management regime in a future international forum. However, impacts are likely to be less than those of Alternative SQA.3 (Sub-objective A Preferred Alternative).

4.11.10.3 Potential Effects of Exogenous Factors

The exogenous factor of relevance is implementation of the Western and Central Pacific Tuna Convention. At its first meeting in December 2004, the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the WCPO indicated its interest in tuna fisheries-associated mortality of non-target species, with an initial focus on seabirds, turtles and sharks, in the Convention Area. The Commission is expected to receive scientific advice on this and other subjects at its next meeting in December 2005 (Western and Central Pacific Fisheries Commission 2004). The potential impact depends on what future management and conservation measures for seabirds, turtles and sharks, if any, are adopted by the Commission. Squid resources and management have not been discussed at the Preparatory Conferences for the Commission or, to date, by the Commission. Management and conservation measures adopted by the Commission would be implemented by its members and "cooperating non-members" (the present status of the U.S.). For example, Commission rules that require fishing vessel markings, descriptions and permitting will be implemented by U.S. government agencies for U.S. vessels, as would any future management and conservation measures for pelagic resources applicable to U.S. vessels in the Convention Area.

4.11.10.4 Potential Cumulative Effects of Alternatives for Seabird Interaction Avoidance

Most of the seabird interaction avoidance alternatives would require some combination of seabird interaction avoidance measures. NMFS observer coverage of at least 20 percent of deep-set Hawaii tuna longline trips and 100% of shallow-set Hawaii swordfish longline trips would allow collection of detailed information about the effectiveness of these measures. Analysis of this data would demonstrate the relative effectiveness of the various measures and greatly facilitate transfer of the most cost-effective measures to multi-national longline fleets. Thus, all of the seabird interaction avoidance alternatives have the potential to accelerate the movement toward multilateral resource management stemming from the Western and Central Pacific Tuna Commission. The cumulative effects of this exogenous factor (i.e., the Commission) would be modified, with positive consequences for North Pacific albatross populations.

4.11.10.5 Potential Cumulative Effects of Alternatives for Squid Jig Fishery Management

The Western and Central Tuna Commission has not yet expressed interest in international monitoring or management of pelagic squid resources. Nevertheless, Alternative SQA.5 and Alternative SQB.6 have the potential to accelerate movement toward any future multilateral squid fishery management by the Commission, thereby modifying cumulative effects of this exogenous factor (i.e, the Commission). Alternative SQA.3 (Preferred Alternative) and Alternative SQA.4 would involve the Council in high seas squid fishery management to a greater extent than other alternatives. This involvement might establish models for future multilateral management. Alternative SQB.2 has the least potential to affect any future Commission management regime for squid.

4.12 Summary of Action Alternatives Analyses

4.12.1 Seabird Alternatives

In Chapter 2, the criteria for evaluation of the alternatives and the seabird interaction avoidance measures (operational characteristics, compliance, efficacy of interaction avoidance, and cost) were introduced. Individual measures and all combinations of two of the measures were described and evaluated. Alternatives were then formulated, and earlier in this chapter, evaluated for their potential impacts to the environment. In particular, Section 4.5 describes impacts of the alternatives to seabirds while Section 4.8 describes the economic effects of the alternatives. This section combines those analyses to provide a comparative summary of the characteristics and impacts of all of the seabird action alternatives. Table 4.12-1 collates the results of analyses of the quantitative and qualitative criteria established to evaluate the degree to which the seabird action alternatives would satisfy the objective of cost-effective reduction of the adverse effects of seabird interactions in the Hawaii-based longline fleet. Both initial and annual recurring costs are summarized from the analyses in Section 4.8 and then compared in terms of the number of years that would be required to recover the initial investment (i.e., initial cost divided by the annual cost of Alternative SB1 (No Action) minus the annual cost of the alternative). Alternatives with annual costs greater than that of Alternative SB1 (No Action) would never recover the initial investment in hardware and installation.

Table 4.12-1 Summary Comparison of Seabird Action Alternatives
(●= good; ●●= better; ●●●=best).

Alternative	Initial Costs	Annual Costs	Initial Cost Recovery Time (Years)	Projected Number of Interactions	Operational Characteristics	Compliance
SB1: all vessels set deep or at night and use blue bait and SOD, north of 23°N – (NO ACTION: Current Measures)	$0	$88,792	0	97	●●	●◖
SB2A: all vessels side-set, or set deep or at night and use blue bait and SOD, north of 23°N	$476,000	$73,990	32.2	11	●●◖	●●●
SB2B: all vessels side-set, or set deep or at night and use blue bait and SOD, in all areas	$516,000	$60,236	18.1	6	●●◖	●●●
SB3A: all vessels use underwater setting chute, or set deep or at night and use blue bait and SOD, north of 23°N	$119,000	$50,190	3.1	146	●	●
SB3B: all vessels use underwater setting chute, or set deep or at night and use blue bait and SOD, in all areas	$129,000	$54,356	3.7	73	●	●
SB4A: all vessels use tori lines, or set deep or at night and use blue bait and SOD, north of 23°N	$119,000	$556,252	Never	311	●	●
SB4B: all vessels use tori lines, or set deep or at night and use blue bait and SOD, in all areas	$129,000	$615,506	Never	248	●	●
SB5A: all vessels side-set or use underwater setting chute or, set deep or at night and use blue bait and SOD, north of 23°N	$437,000	$17,402	6.1	27	●●◖	●●●

Alternative	Initial Costs	Annual Costs	Initial Cost Recovery Time (Years)	Projected Number of Interactions	Operational Characteristics	Compliance
SB5B: all vessels side-set or use underwater setting chute or, set deep or at night and use blue bait and SOD, in all areas	$474,000	$31,356	8.3	13	●●◖	●●●
SB6A: all vessels side-set or use underwater setting chute or tori lines, or set deep or at night and use blue bait and SOD, north of 23°N	$398,000	$76,552	32.5	59	●●◖	●●●
SB6B: all vessels side-set or use underwater setting chute or tori lines, or set deep or at night and use blue bait and SOD, in all areas	$428,000	$95,006	Never	39	●●◖	●●●
SB7A: all vessels side-set or use tori lines, or set deep or at night and use blue bait and SOD, north of 23°N	$437,000	$73,952	29.4	46	●●◖	●●●
SB7B: all vessels side-set or use tori lines, or set deep or at night and use blue bait and SOD, in all areas	$474,000	$92,256	Never	32	●●◖	●●●
SB7C: shallow-set vessels side-set, or use underwater setting chute or tori lines or night set, in all areas; deep-set vessels side-set, or use underwater setting chute or tori lines, north of 23°N	$398,000	$69,650	20.8	61	●●◖	●●●
SB7D: shallow-set vessels side-set or set at night and use tori lines and blue bait and SOD, in all areas; deep-set vessels side-set, or use tori lines and blue bait and SOD, north of 23°N (Preferred Alternative)	$507,000	$43,154	11.1	6	●●◖	●●●

Alternative	Initial Costs	Annual Costs	Initial Cost Recovery Time (Years)	Projected Number of Interactions	Operational Characteristics	Compliance
SB7E: shallow-set vessels side-set or set at night and use tori lines, in all areas; deep-set vessels side-set, or use tori lines north of 23°N	$489,000	$65,750	21.2	17	●●◖	●●●
8A: all vessels side-set and set deep or at night and use blue bait and SOD, north of 23°N	$528,000	$95,392	Never	0	●●◖	●●●
8B: all vessels side-set and set deep or at night and use blue bait and SOD, in all areas	$572,000	$228,590	Never	0	●●◖	●●●
9A: all vessels side-set north of 23°N	$528,000	$6,600	6.4	2	●●◖	●●●
9B: all vessels side-set in all areas	$572,000	$7,150	7.0	3	●●◖	●●●
10A: all vessels side-set if feasible, otherwise set deep or at night and use blue bait and SOD, north of 23°N	$500,000	$10,758	6.4	7	●●◖	●●●
10B: all vessels side-set if feasible, otherwise set deep or at night and use blue bait and SOD, in all areas	$544,000	$17,846	7.7	4	●●◖	●●●
11A: all vessels side-set if feasible, otherwise use underwater setting chute, or tori lines, or set deep or at night, north of 23°N	$503,000	$15,700	6.9	23	●●◖	●●●
11B: all vessels side-set if feasible, otherwise use underwater setting chute, or tori lines, or set deep or at night, in all areas	$547,000	$16,250	7.5	18	●●◖	●●●
12: all vessels voluntarily night set, use underwater setting chute or tori line, or set deep south of 23°N	$0	$88,792	0	80	●●	●◖

The projected numbers of interactions are summarized from Table 4.5-3. The qualitative evaluations of the operational characteristics and compliance criteria for the alternatives are based on the ratings in Table 2.1-1 for the dominant seabird avoidance measure anticipated to be used in deriving the projections of interactions for each alternative. In comparing the ratings of the qualitative criteria with the projections of interactions, a general correlation is seen. The alternatives rated lowest qualitatively (SB3A, SB3B, SB4A and SB4B) also were among those with the highest projected numbers of seabird interactions (range: 73-311). Alternatives with intermediate qualitative ratings (SB1, No Action, and SB12) had lower, but still relatively high, interaction projections (range: 80-97). Alternatives in those two categories can therefore be discounted on the basis of both qualitative characteristics and seabird interaction avoidance efficacy. SB4A and SB4B also had high operating costs related to annual replacements of tori line components.

The remainder of the alternatives were rated highly against the qualitative criteria, primarily because side-setting was the dominant interaction avoidance measure used, and tended to produce the lowest projected numbers of interactions. Within that group of alternatives, those mandating the use of side-setting (SB8A, SB8B, SB9A, SB9B) had the highest initial costs (range: $528,000-$572,000). Alternatives SB8A and SB8B also had annual costs higher than those of SB1 (No Action), meaning that the initial investment would never be recovered. These latter alternatives can be discounted on the basis of their high initial costs, but perhaps more importantly because they mandate the use of a measure (side-setting) that has undergone only very limited testing. While results with this measure have been very promising, it appears appropriate to gather more performance data under actual fleet operating conditions before mandating its universal application.

On the basis of cost-effectiveness, the "B" versions of alternatives SB2, SB5, SB6, SB7, SB10, and SB11 had higher initial and annual costs than the "A" versions, while offering modest reductions of projected seabird interactions, and thus they were discounted.

Several of the remaining alternatives (SB6A, SB7A, SB7C, and SB7E) would permit the use of tori lines without other interaction avoidance measures. Although tori lines may be further developed to function more effectively in the Hawaii longline fishery, the available experimental efficacy value is the lowest of those measures considered here. These alternatives would have the potential to reduce interaction avoidance efficacies compared to currently required measures, and would not satisfy that aspect of the action objective. They were consequently discounted.

That leaves a short-list of three alternatives, SB2A, SB5A and SB7D (Preferred Alternative), that best meet the action objectives. Alternative 2A offers side-setting as an option to using currently required measures. This alternative recognizes the potential operational and seabird interaction reduction benefits of side-setting, while maintaining flexibility for individual vessel operators and recognizing that it may be premature to mandate the use of side-setting throughout the fleet. Alternative SB5A is identical to SB2A except that it offers the additional option to use underwater setting chutes. Setting chutes have shown high interaction avoidance efficacies in trials, but they have also suffered from structural failures which seriously compromised their interaction avoidance efficacies as well as their fishing efficiencies. It would seem that authorization of their use as a substitute for currently required measures in the Hawaii longline fleet is premature, and should be delayed pending further design development and testing.

That leaves Alternatives SB2A and SB7D as the highest rated alternatives. Alternative SB7D is the Preferred Alternative. Although its initial costs are somewhat higher than those of Alternative SB2A, its annual costs are lower, and the payback period on the initial investment is considerably less. In addition, its projected seabird interactions are lower. Alternative SB7D was designed to improve on Alternative SB2A in several ways. Like Alternative SB2A, it offers the option of using side-setting in place of currently required interaction avoidance measures. However, it strengthens the incentive to use side-setting by requiring mandatory use of tori lines along with currently required measures if side-setting is not used. Thus, this alternative has the potential to improve upon the efficacy of currently required measures regardless of which option is adopted by a given vessel. In addition, Alternative SB7D requires all shallow-setting vessels to use interaction avoidance measures wherever they fish, not just north of 23°N latitude, as in Alternative SB2A. As this sector of the fleet will have 100% observer coverage, implementation of Alternative SB7D will also provide comprehensive data on the efficacy of the measures employed in areas where seabirds are abundant or not. Alternative SB7D also encourages the use of side-setting in the deep-setting sector of the fishery by requiring mandatory use of tori lines along with currently required measures if side-setting is not used at latitudes above 23°N latitude, where seabirds and interactions are most prevalent. On the other hand, it does not impose measures on deep-setting vessels fishing south of 23°N latitude. Cost-effectiveness of the alternative is supported because deep sets in the south are the most common type of set, and they have the lowest historical rate of seabird interactions per set. Deep-setting vessels fishing south of 23°N latitude, a category that includes the smallest vessels in the fleet (Appendix D), would thus retain the option to fish without employing seabird interaction avoidance measures if they fished exclusively south of 23°N latitude.

4.12.2 Squid Alternatives

This section summarizes the impacts of the squid jig fishery management alternatives on potentially affected environmental resources. Because of the similarity of the potential impacts of the action alternatives to related resources, resources are grouped for this discussion.

With the possible exception of Alternative SQB.2 (cessation of issuing HSFCA permits for squid fishing), none of the alternatives for squid jig fishery management would significantly change current impacts of these vessels to the pelagic environment, PMUS, non-PMUS or squid stocks. Alternative SQB.2 would most likely reduce wastes discharged from squid processing but indirectly increase the discharge of waste from the vessels when rededicated to other uses. That alternative would also directly reduce the harvest of squid, and potentially indirectly increase the harvest of PMUS and non-PMUS, depending on the uses to which the displaced vessels are put. As there are only four vessels that would be affected, impacts of Alternative SQB.2 would be insignificant to the pelagic environment, PMUS, non-PMUS or squid stocks.

None of the alternatives for squid jig fishery management would be expected to directly affect North Pacific seabird, sea turtle or marine mammal resources. Alternative SQB.2 would phase out the current small U.S. pelagic squid fleet and the indirect effect of this alternative on seabirds, sea turtles or marine mammals would depend on the uses to which the displaced vessels are put. However, even if all four current squid vessels were to enter fisheries where these animals are incidentally hooked, their impact would be insignificant in the context of the total effort in international fisheries in the Pacific Ocean.

Alternative SQB.2 would have significant social and economic impacts on the one domestic operation currently engaged in fishing for squid on the high seas, but these impacts would be insignificant in a regional or national context. Without a HSFCA permit, the existing operation would no longer be able to legally participate in the fishery. Owners and crews of displaced vessels would suffer a loss of income and the boats might have to be sold for a loss. Approximately 54 crew members would have to find alternative employment. The other alternatives would have insignificant social or economic effects at any scale.

Alternative SQB.2 would eliminate administrative costs but maintain enforcement costs at current levels as HSFCA permits are phased out for U.S. high seas squid fisheries. Alternative SQA.1 (sub-objective A No Action) and Alternative SQB.1 (sub-objective B No Action) would continue current direct and indirect effects on administration and enforcement. Alternative SQA.2, Alternative SQB.3, Alternative SQB.4 (sub-objective B Preferred Alternative) and Alternative SQB.5 would entail some additional administrative, although not enforcement efforts. Alternative SQA.3 (sub-objective A Preferred Alternative) would trigger all of the administrative activities associated with managing PMUS under the Pelagics FMP but enforcement would remain at current levels because no new rules would be imposed. Alternative SQA.4 would have the greatest administrative costs of the "A" series alternatives because of the activities associated with a new FMP, but enforcement would remain at current levels because no new rules would be imposed. Direct and indirect effects to administration and enforcement under Alternative SQA.5 and Alternative SQB.6 are uncertain because they would be determined after agreement on a management regime in a future international forum. However, impacts are likely to be less than those of Alternative SQA.3 (sub-objective A Preferred Alternative).

The Western and Central Tuna Commission has not yet expressed interest in international monitoring or management of pelagic squid resources. Nevertheless, Alternative SQA.5 and Alternative SQB.6 have the potential to accelerate movement toward any future multilateral squid fishery management by the Commission, thereby modifying cumulative effects of this exogenous factor (i.e, the Commission). Alternative SQA.3 (sub-objective A Preferred Alternative) and Alternative SQA.4 would involve the Council in high seas squid fishery management to a greater extent than other alternatives. This involvement might establish models for future multilateral management. Alternative SQB.2 has the least potential to affect any future Commission management regime for squid.

In summary, most of the alternatives, with the exception of Alternative SQB.2, cessation of issuing permits, would have insignificant impacts to environmental resources. They would indirectly benefit biological resources by providing for enhanced monitoring of the effects of squid jigging on those resources. Alternative SQB.2 would terminate high seas squid jigging by U.S. vessels, with resulting significant direct impacts to participants. More broadly, however, its impacts would ultimately depend on the uses to which the displaced vessels are put. Considering that the fleet presently consists of only four vessels, potential impacts would not be significant to any environmental resources.